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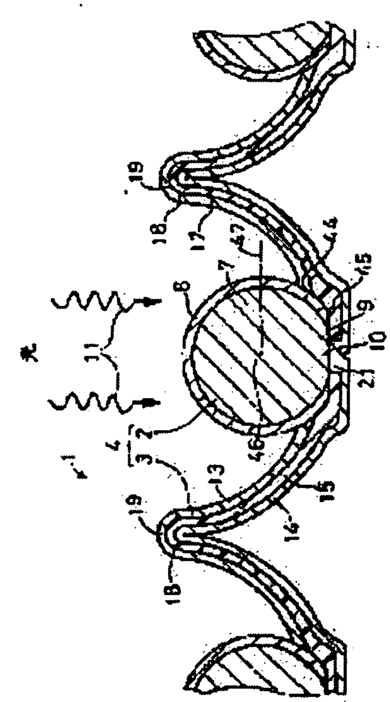
(71)Applicant : HAMAKAWA YOSHIHIRO
MUROZONO MIKIO
TAKAKURA HIDEYUKI

(72)Inventor : HAMAKAWA YOSHIHIRO
MUROZONO MIKIO
TAKAKURA HIDEYUKI

(54) PHOTOVOLTAIC DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a photovoltaic device at low cost by reducing the consumption of high purity Si material.
SOLUTION: Photoelectric conversion elements 2 are mounted in a plurality of recesses 17 formed on a support 3, respectively, and reflected light inside the recesses 17 is cast to the photoelectric conversion element 2. The photoelectric conversion element is almost spherical, and a p-type amorphous SiC (abbreviated a-SiC) layer 8 with an optical band gap wider than an n-type amorphous Si (abbreviated a-Si) is applied to the outer side of the n-type a-Si layer 7 on the center side. Then a p-n junction is formed. A first conductor 13 of the support is connected with the p-type a-SiC layer 8 of the photoelectric conversion element at the bottom of a recess or the nearby place thereof. A second conductor 14 through an electrical insulator 15 of the support is connected with the n-type a-Si layer 7 of the photoelectric conversion element.



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CLAIMS

[Claim(s)]
[Claim 1] (a) Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It is the optical power plant characterized by connecting with the 2nd semi-conductor layer of an optoelectric transducer electrically, and the 2nd conductor containing the base material electrically connected to said exposed part of the 1st semi-conductor layer.
[Claim 2] The outer diameter of an optoelectric transducer is an optical power plant according to claim 1 characterized by being 0.5-2mmphi.
[Claim 3] The central angle theta 1 of opening of said 2nd semi-conductor layer is an optical power plant according to claim 1 or 2 characterized by being 45-90 degrees.
[Claim 4] The opening edge of the crevice formed in the base material for example, each opening edge which is the polygon of the shape of a blow hole of a bee, and adjoins mutually Continuously, it is formed in the shape of a taper as a crevice becomes a bottom, and they are the bottom of a crevice, or its circumference. The optical power plant of one publication among claims 1-3 characterized by connecting electrically the 1st and 2nd semi-conductor layer of an optoelectric transducer to the 2nd and 1st conductors insulated electrically mutually, respectively.
[Claim 5] On the bottom of the crevice of a base material, or the outskirts of it, to the 1st conductor While the circular 1st connection hole 39 is formed, to an electric insulator The circular 2nd connection hole 40 which has an axis is formed on the straight line containing the axis of the 1st connection hole 39. Near [said] opening of an optoelectric transducer It fits into the 1st connection hole 39. The peripheral face of the upper part of opening of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part near an end face The optical power plant according to claim 4 characterized by connecting electrically and connecting electrically to the 2nd conductor said part of the 1st semi-conductor layer exposed from said opening through the 2nd connection hole 40.
[Claim 6] The optical power plant according to claim 5 characterized by choosing it as D1>D3>D2>D4 when set the outer diameter of an optoelectric transducer to D1, the bore of opening of said 2nd semi-conductor layer is set to D2, the bore of the 1st connection hole 39 is set to D3 and the bore of the 2nd connection hole 40 is set to D4.
[Claim 7] The optical power plant of one publication among claims 1-6 characterized by choosing condensing ratio x=S1/S2 as 2-8 when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2.
[Claim 8] (a) Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the

enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer The optical power plant characterized by choosing condensing ratio x=S1/S2 as 2-8 when it is 0.5-2mmphi, area of the opening edge of the crevice of a base material is set to S1 and the cross section including the core of an optoelectric transducer is set to S2.
[Claim 9] (a) Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer The optical power plant characterized by choosing condensing ratio x=S1/S2 as 4-6 when it is 0.8-1.2mmphi, area of the opening edge of the crevice of a base material is set to S1 and the cross section including the core of an optoelectric transducer is set to S2.
[Claim 10] An optoelectric transducer is the optical power plant of one publication among claims 1-9 characterized by forming in a way the 2nd semi-conductor layer of the another side electric conduction format that an optical band gap is larger than the 1st semi-conductor layer, outside the 1st semi-conductor layer of an electric conduction format, and on the other hand having pn junction.
[Claim 11] An optoelectric transducer is the optical power plant of one publication among claims 1-9 characterized by forming an amorphous intrinsic-semiconductor layer and the amorphous 2nd semi-conductor layer of an another side electric conduction format with an optical band gap larger than the 1st semi-conductor layer in this sequence at a way, and having a pin junction outside the 1st semi-conductor layer of an electric conduction format on the other hand.
[Claim 12] It is the optical power plant according to claim 10 or 11 which the 1st semi-conductor layer is the n form Si, and is characterized by the 2nd semi-conductor layer being p form amorphous silicon C.
[Claim 13] The n form Si which is the 1st semi-conductor layer is an optical power plant according to claim 12 characterized by being n form crystal Si or n form microcrystal (muc) Si.
[Claim 14] An optoelectric transducer is the optical power plant of one publication among claims 1-9 characterized by having stack form structure including the internal cel which has the 1st semi-conductor layer of the method of the innermost, and the external cel which is formed in a way outside the internal cel, and has the 2nd semi-conductor layer of the outermost direction.
[Claim 15] It is the optical power plant according to claim 14 which an internal cel has a pn junction layer or a pin junction layer, and is characterized by an external cel having a pn junction layer or a pin junction layer.
[Claim 16] On the other hand, an internal cel has the 1st semi-conductor layer of an electric conduction format, and the semi-conductor layer of the amorphous and/or the microcrystal of an another side electric conduction format in order outside from inside, and an external cel is an optical power plant according to claim 15 with an optical band gap larger than an amorphous pin junction layer and this pin junction layer characterized by amorphous or having the 2nd semi-conductor layer of a microcrystal from inside to order in outside.
[Claim 17] On the other hand, an internal cel is the 1st semi-conductor layer of an electric conduction format, and amorphous and/or the optical power plant according to claim 15 which has the semi-conductor layer of a microcrystal and is characterized by on the other hand an external cel having the microcrystal semi-conductor layer of an electric conduction format, an amorphous intrinsic-semiconductor layer, and the 2nd semi-conductor layer of the microcrystal of an another side electric conduction format in order from inside to outside of an another side electric conduction format to order in the outside from inside.
[Claim 18] It is the optical power plant according to claim 15 which an internal cel, on the other hand, has the amorphous 1st semi-conductor layer of an electric conduction format, an amorphous intrinsic-semiconductor layer, and the amorphous semiconductor layer of an another side electric conduction format in order outside from inside, and is characterized by on the other hand an external cel having the microcrystal semi-conductor layer of

an electric conduction format, an amorphous intrinsic-semiconductor layer, and the 2nd semi-conductor layer of the microcrystal of an another side electric conduction format in order from inside to outside.
[Claim 19] Outside an internal cel in order from inside The 1st semi-conductor layer with an electric conduction format amorphous on the other hand, It has the intrinsic-semiconductor layer of a microcrystal, and an amorphous semiconductor layer with an optical band gap are an another side electric conduction format and larger than the 1st semi-conductor layer. An external cel The optical power plant according to claim 10 characterized by on the other hand having the microcrystal semi-conductor layer of an electric conduction format, an amorphous intrinsic-semiconductor layer, and the 2nd semi-conductor layer of the microcrystal of an another side electric conduction format in order outside from inside.
[Claim 20] The 1st semi-conductor layer is the optical power plant of one publication among claims 1-19 characterized by being a direct semiconductor layer.
[Claim 21] A direct semiconductor layer is an optical power plant according to claim 20 characterized by being one kind chosen from the group who consists of InAs, GaSb, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe.
[Claim 22] It is the optical power plant of one publication among claims 1-21 which two or more base materials adjoin, and are arranged, and the periphery of each base material is extended and formed in the method of outside, are this periphery, and are characterized by the thing for which the 1st conductor of a base material and the 2nd conductor of the base material of another side are connected electrically repeatedly while adjoining.
[Claim 23] Said each periphery is an optical power plant according to claim 22 which starts, has a part or a falling part and is characterized by starting, and for a part or a falling part piling up and connecting electrically.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention] This invention relates to an optical power plant. A pin junction must be interpreted as a thing including the configuration by which each semi-conductor layer of n form, i form, and p form was formed one by one in outside [from] or inside from outside at the target among almost spherical optoelectric transducers among this description.
[Description of the Prior Art] The 1st typical advanced technology contains the optoelectric transducer which consists of a crystal silicon semi-conductor wafer. In this 1st advanced technology, the process for manufacturing a crystal is complicated and costs become high. Moreover, since a semi-conductor wafer is manufactured through processes, such as cutting, slicing, and polishing, from single crystal bulk, a process is complicated, and the cut waste of the crystal further produced at processes, such as the cutting, slicing, and polishing, makes it a capacity factor, becomes about 50% or more, and becomes useless. Other 2nd advanced technology which solves this problem consists of an amorphous silicon (abbreviated-name a-Si) thin film. Since this 2nd advanced technology forms a photo-electric-translation layer by the shape of a thin film by plasma chemistry vapor growth, its processes, such as cutting from the single crystal bulk of the conventional technique, slicing, and polishing, are unnecessary, and it has the advantage that all the deposited film can be used as a barrier layer of a component. On the other hand, it originates in amorphous structure, and many crystal defects, i.e., gap States, exist in the interior of a semi-conductor, therefore an optical induction degradation phenomenon exists, and an amorphous silicon solar battery has the problem that photoelectric conversion efficiency falls. In order to solve this problem, in the former, the technique inactivated by the hydrogen treating is developed and manufacture of electron devices, such as an amorphous silicon solar battery, is attained. However, also by such processing, it is impossible to abolish the effectiveness of a crystal defect, for example, the weak point that photoelectric conversion efficiency deteriorates about 15 to 25% is still held in the amorphous silicon solar battery. The stack form solar battery which makes i layers of photoelectrical activity extremely thin, and makes a photovoltaic cell 2 junction or 3 junction as a new technique which controls the photodegradation in which it succeeded recently was realized, and it has succeeded in controlling photodegradation to about 10%. Although the module technique of it becoming clear photodegradation being recovered, and operating/working in such the condition is also being developed when this photodegradation has a high operating temperature of a photovoltaic cell, it is hard to say that it is enough. Other 3rd advanced technology is indicated by the pan which solves such a problem at JP,7-54855,B. The n form Si epidermis section is etched into the flat aluminium foil with which the hole opened the spherical particle which has the n form Si epidermis section in a p form Si ball from the rear face of a pad and its aluminium foil, an internal p form Si ball is exposed, this exposed p form Si ball is connected to another aluminium foil, and a solar array consists of this 3rd advanced technology. It is necessary to mitigate the amount of Si used of a high grade, to make small a drawing wax, then the outer diameter of a particle for reduction of the cost price, and to make the whole average thickness thin in this 3rd advanced technology. Moreover, the particle of a large number which need to enlarge a light-receiving side in order to aim at improvement in conversion efficiency, approach mutually, arrange a particle in order to enlarge the light-receiving side, therefore have a small outer diameter must be arranged densely, and must be connected to aluminium foil. Consequently, the connection routing of a particle and aluminium foil becomes complicated, and it is inferior to reduction of the cost price.
[Problem(s) to be Solved by the Invention] It reduces the amount of the semiconductor materials used, such as Si of a high grade, and moreover the object of this invention is easy to mass-produce, that is, is offering the high-reliability which enables manufacture of saving resources and an energy-saving form, and is realized cheaply, and an efficient optical power plant.
[Means for Solving the Problem] Have an almost spherical configuration and it has the 1st semi-conductor layer

and the 2nd semi-conductor layer of the method of outside [it]. this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It is the optical power plant characterized by connecting with the 2nd semi-conductor layer of an optoelectric transducer electrically, and the 2nd conductor containing the base material electrically connected to said exposed part of the 1st semi-conductor layer. If this invention is followed, two or more almost spherical optoelectric transducers of each will be arranged in two or more crevices of each of a base material, respectively. The inner surface of this crevice It is formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor, therefore it is reflected by the 1st conductor or the enveloping layer formed upwards the 1st conductor of a crevice inner surface, and the light from the outside, such as sunlight, is irradiated by the optoelectric transducer while it is directly irradiated by the optoelectric transducer. Since an optoelectric transducer is arranged in a crevice, spacing is opened mutually, and it is prepared in it, namely, an optoelectric transducer is not arranged densely. Therefore, while being able to reduce the amount of the ingredients used, such as the high grade which decreases the number of an optoelectric transducer and constitutes an optoelectric transducer, for example, Si etc., the connection process of an optoelectric transducer and the conductor of a base material can be made easy. And two or more crevices are adjoined and formed mutually, by this, it reflects by the crevice inner surface, the light from the outside irradiates an optoelectric transducer, and the light from the outside can be effectively used for it for generating of the photoelectromotive force of an optoelectric transducer. In this way, generated output per [which faces the light source of the optoelectric transducer of this invention] unit area can be enlarged as much as possible. You may change from a single crystal, polycrystal, or an amorphous ingredient to the optoelectric transducer of this invention, and may change from the ingredient of a silicon system, a compound semiconductor system, and others to it, may have each structure of pn form and a pin form, in addition may have the configuration of for example, a shot key barrier form, an MIS (metal-insulator-semiconductor) form, a gay junction type, a heterojunction form, and others. It has exposed selectively from opening of the outside 2nd semi-conductor layer, and the 1st semi-conductor layer by the side of a core can take out the photoelectromotive force generated at the time of an optical exposure from between these 1st and 2nd semi-conductor layers. The 2nd semi-conductor layer of the optoelectric transducer arranged in the crevice of a base material is electrically connected to the 1st conductor of a base material. The exposed part of the 1st semi-conductor layer inside an optoelectric transducer is electrically connected with the 1st conductor at the 2nd conductor prepared through the electric insulator. With the structure where the 1st conductor and the 2nd conductor are formed in the shape of a field, with these 1st and 2nd conductors, parallel connection of two or more optoelectric transducers is carried out, and they can derive a big current. Although an optoelectric transducer may be a real ball, even if it is not a real ball, if the outside surface is [other than a real ball] almost spherical, it is good. The 1st semi-conductor layer may have the configuration near [whose] the core of the again almost spherical 1st semi-conductor layer you may be the configuration that the 1st semi-conductor layer was covered and formed in the peripheral face of the axis prepared beforehand, or is a cavity with other gestalten of operation of this invention, although a solid may be formed almost spherically. Moreover, this invention is characterized by the outer diameter of an optoelectric transducer being 0.5-2mmphi. As long as it follows this invention, the outer diameter of an optoelectric transducer may be 0.5-2mmphi, and may be 0.8-1.2mmphi preferably, or may be about 1mmphi again. While lessening enough the amount of the ingredients used, such as Si of a high grade, and being able to enlarge generating power now as much as possible moreover by this, handling of the spherical optoelectric transducer at the time of manufacture is easy, and productivity is excellent. Moreover, this invention is characterized by the central angle theta 1 of opening of said 2nd semi-conductor layer being 45-90 degrees. If this invention is followed, by choosing the central angle theta 1 as 60-90 degrees still more preferably by choosing it as 45-90 degrees as mentioned above, the 1st and 2nd semi-conductor layer can reduce the amount discarded by formation of said opening, and can control futility. And the area of opening required for the electrical installation of the 1st semi-conductor layer and the 2nd conductor of a base material can be obtained by choosing the central angle theta 1 as the range of such a value. Moreover, the opening edge of the crevice where this invention was formed in the base material For example, each opening edge which is the polygon of the shape of a blow hole of a bee, and adjoins mutually Continuously, a crevice is formed in the shape of a taper as it becomes a bottom, it is the bottom of a crevice, or its circumference, and is

characterized by connecting with the 2nd and 1st conductors with which the 1st and 2nd semi-conductor layer of an optoelectric transducer is insulated electrically mutually electrically, respectively. This invention is the bottom of the crevice of a base material, or its circumference. Moreover, to the 1st conductor While the circular 1st connection hole 39 is formed, to an electric insulator The circular 2nd connection hole 40 which has an axis is formed on the straight line containing the axis of the 1st connection hole 39. Near [said] opening of an optoelectric transducer It fits into the 1st connection hole 39. The peripheral face of the upper part of opening of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part near an end face It is characterized by connecting electrically and connecting electrically to the 2nd conductor said part of the 1st semi-conductor layer exposed from said opening through the 2nd connection hole 40. Moreover, when this invention sets the outer diameter of an optoelectric transducer to D1, the bore of opening of said 2nd semi-conductor layer is set to D2, the bore of the 1st connection hole 39 is set to D3 and the bore of the 2nd connection hole 40 is set to D4, it is characterized by choosing it as D1>D3>D2>D4. Before the 1st semi-conductor layer which near [said] opening of an optoelectric transducer fitted into the 1st connection hole 39 of the 1st conductor, and was exposed to it from the opening when following this invention The Norikazu part is electrically connected to the 2nd conductor through the 2nd connection hole 40 formed in the electric insulator of a base material. The 1st and 2nd conductors of the base material which has the 1st conductor, an electric insulator, and the 2nd conductor by this can be easily connected now to the 2nd and 1st semi-conductor layer and the electric target of an optoelectric transducer, respectively. The part which surrounds the 1st connection hole 39 rather than the opening 9 of below-mentioned drawing 1 in the upper part the inner skin of the peripheral face of the upper part of the opening 9 of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part 39 near an end face, i.e., the 1st connection hole, and/or near [1st connection hole 39] the is electrically connected about the electrical installation of the 2nd semi-conductor layer and the 1st conductor. the conductive paste which upheaved, plastic deformation could be carried out, and could be connected [the 2nd conductor 14 could insert the 2nd connection hole 40 in the part 10 exposed from the opening 9 of the 1st semi-conductor layer 7, for example,] electrically, or was prepared in the 2nd connection hole 40 -- or conductive bumps, such as a metal, etc. may connect with the 2nd conductor 14 electrically. Moreover, by choosing these outer diameter D1 and bores D2, D3, and D4 as the above-mentioned inequality, an electric short circuit [**** / un-] is prevented and positive electrical installation becomes possible. Moreover, this invention is characterized by choosing condensing ratio x=S1/S2 as 2-8, when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2. Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. moreover, this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer It is 0.5-2mmphi, and when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2, it is the optical power plant characterized by choosing condensing ratio x=S1/S2 as 2-8. Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. moreover, this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer It is 0.8-1.2mmphi, and when setting area of the

opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2, it is the optical power plant characterized by choosing condensing ratio x=S1/S2 as 4-6. if this invention is followed -- the opening edge of the crevice of a base material -- for example, a swage block -- it may be the polygon of a **, for example, you may be a hexagon, and this crevice is formed in the shape of a taper as it becomes a bottom, and an optoelectric transducer arranges it at that bottom -- having -- that optoelectric transducer -- the bottom of a crevice, or its circumference -- it is -- a base material -- each -- it connects with a conductor. The opening edge of a crevice is a polygon, and when each opening edge continues, all the carrier beam light can be irradiated at an optoelectric transducer the whole surface other than the location of the optoelectric transducer in the base material which faces the light sources, such as sunlight. Therefore, so to speak, a condensing form optoelectric transducer is [condensing ratio x=S1/S2] preferably realizable as two to 8 times as four to 6 times. Mutual spacing of an optoelectric transducer can be enlarged as mentioned above by this, and the number of an optoelectric transducer can be decreased, and an electric connection routing with a base material can be simplified. Therefore, the amount of the high grade semi-conductor used used as the ingredient of an optoelectric transducer can be decreased, and this invention can be cheaply carried out now. It is comparatively easy, and the configuration of a base material is excellent in productivity, and easy to manufacture. for example, according to the experiment of this artificer, with this light power plant formed so that the outer diameter might be set to 800-1000 micrometerphi, the optoelectric transducer which consists of almost spherical Si Si of the same weight as Si which constitutes all the optoelectric transducers used with four to 6 times, then an optical power plant in the condensing ratio x The thickness when converting into the plate which has an area equal to the projected area to a virtual flat surface vertical to a beam of light from the light source to an optical power plant on imagination It is set to about 90-120 micrometers, therefore the epoch-making result that the amount of Si used of per generating power 1W can be managed with the value of less than 2g can be obtained. In the 1st advanced technology of the optoelectric transducer which consists of the above-mentioned crystal silicon semi-conductor wafer, the thickness of crystal silicon is 350-500 micrometers, and if a slice loss is included, it will be set to about 1mm. Therefore, in the 1st advanced technology, the amount of Si used of per generating power 1W is about abbreviation 15-20g. Therefore, in this invention, the amount of Si used is substantially mitigable compared with the 1st above-mentioned advanced technology. The condensing effectiveness which the condensing ratio x can decrease the value exceeding 8, then the number which needs an optoelectric transducer, and can mitigate further the amount of Si used of per generating power 1W, but on the other hand is a ratio to the light energy absorbed by the optoelectric transducer of the light energy by which incidence was carried out to the crevice with the increment in the condensing ratio x actually worsens, and it is **. ****** and performance degradation will be caused. If this invention is furthermore followed, while choosing the outer diameter of an optoelectric transducer as 0.5-2mmphi and choosing it as 0.8-1.2mmphi preferably as above-mentioned While being able to decrease the number of optoelectric transducers and being able to mitigate the amount of Si used of per generating power 1W by choosing the condensing ratio x as 2-8, and choosing it as 4-6 preferably, the electric connection routing of an optoelectric transducer and a base material can be simplified further. Thus, the combination with numerical selection of the outer diameter of an optoelectric transducer is important in order to decrease the number of optoelectric transducers and to reduce the amount of Si used of per generating power 1W. With the configuration with which the number which needs an optoelectric transducer increases, and the outer diameter exceeds 2mmphi although the outer diameter of an optoelectric transducer reduces the amount of Si used under by 0.5mmphi, although the number which needs an optoelectric transducer decreases, the amount of Si used will increase. If the condensing ratio x cannot reduce the amount of Si used enough and exceeds 8 less than by two, condensing effectiveness will get worse to less than 80%, and it will result in causing performance degradation. In this invention, by choosing the condensing ratio x as the range of the above-mentioned value, condensing effectiveness can be made into 80% or more, and it can be 90 more% or more now. In this way, if this invention is followed, the outer diameter and the condensing ratio x of an optoelectric transducer will be chosen as the above-mentioned range of number, and the effectiveness which stood high that each of numbers which need an optoelectric transducer, and amount of Si used of per generating power 1W can be sharply decreased to 1 / 5 - 1/10 compared with the 3rd above-mentioned advanced technology by this will be attained. Moreover, with the configuration which condensed by the above-mentioned condensing ratio using the amorphous silicon optoelectric transducer according to this invention, the temperature of an optoelectric transducer is raised compared with the optoelectric transducer of amorphous silicon sheet metal, for example, can be made into 40-80 degrees C. It is possible to control degradation of an amorphous silicon optoelectric transducer and to make it long lasting by this. Moreover, an optoelectric transducer is characterized by forming in a way the 2nd semi-conductor layer 65 of the another side electric conduction format that an optical band gap is larger than the 1st semi-conductor layer, outside the 1st semi-conductor layer 64 of

'an electric conduction format, and on the other hand, having pn junction like drawing 14 in this invention. Moreover, on the other hand, an optoelectric transducer is characterized by forming the amorphous intrinsic-semiconductor layers 69 and 74 and the amorphous 2nd semi-conductor layers 70 and 76 of an another side electric conduction format with an optical band gap larger than the 1st semi-conductor layer in this sequence at a way, and having a pin junction outside the 1st semi-conductor layers 68 and 73 of an electric conduction format like drawing 15 and drawing 16 in this invention. Moreover, the 1st semi-conductor layer of this invention is the n form Si, and the 2nd semi-conductor layer is characterized by being p form amorphous silicon C. Moreover, it is characterized by the n form Si where this invention is the 1st semi-conductor layer being n form crystal Si or n form microcrystal (muc) Si. If this invention is followed, an amorphous semiconductor of a different kind constitutes the heterojunction aperture structure of pn or pin. The optical band gap of the 2nd semi-conductor layer of the aperture ingredient which exists in the incidence side of light It is made larger than the inside 1st semi-conductor layer, and the optical absorption multiplier of the 2nd semi-conductor layer is made small, and light is made not to be absorbed in this 2nd semi-conductor layer by this. Recombination with the electron in a surface layer and an electron hole is reduced, optical absorption loss is mitigated, and the sensibility by the side of short wavelength can be increased, and a wide gap aperture operation can be attained, consequently an energy conversion efficiency can be improved. While leading more light energies to the intrinsic-semiconductor layer (i layers) which is especially a photoelectromotive-force generating layer with pin junction structure, the sensibility by the side of short wavelength is increased, and a wide gap aperture operation can be attained. In this invention, energy conversion actuation which was extremely excellent in the way compared with the particle in which the n form Si epidermis section was formed, outside the p form Si ball in the above-mentioned advanced technology will be performed. Light is absorbed, an electron and an electron hole pair are made from i layers of an optoelectric transducer which have a pin junction, the duty which generates and conveys a photocurrent is achieved, and p layers and n layers fix Fermi level near a valence band and the conduction band, and achieve the duty which makes the internal field which carries the electron generated in i layers, and an electron hole to two electrodes, and collects optical generation carriers. In this way, improvement in an energy conversion efficiency is achieved. Moreover, an optoelectric transducer is characterized by having stack form structure like drawing 17 in this invention including the internal cel 81 which has the 1st semi-conductor layer of the method of the innermost, and the external cel 82 which is formed in a way outside the internal cel, and has the 2nd semi-conductor layer of the outermost direction. Moreover, the internal cel 81 is characterized by for this invention having a pn junction layer or a pin junction layer, and the external cel 82 having a pn junction layer or a pin junction layer. Moreover, on the other hand, this invention has the 1st semi-conductor layer 84 of an electric conduction format, and amorphous and/or the semi-conductor layer 85 of a microcrystal of an another side electric conduction format in order outside from inside, and, as for the internal cel 81, the external cel 82 is characterized by the thing with a large optical band gap for which it has amorphous or the 2nd semi-conductor layer 87 of a microcrystal outside from inside at order rather than the amorphous pin junction layer 86 and this pin junction layer. This invention like drawing 18 moreover, the internal cel 101 In order, on the other hand, it has the 1st semi-conductor layer 104 of an electric conduction format, and amorphous and/or the semi-conductor layer 105,106 of a microcrystal of an another side electric conduction format outside from inside. The external cel 102 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 107 of an electric conduction format, the amorphous intrinsic-semiconductor layer 108, and the 2nd semi-conductor layer 111 of the microcrystal of an another side electric conduction format outside from inside. This invention like drawing 19 moreover, the internal cel 112 In order, from inside, outside The 1st semi-conductor layer 114 with an electric conduction format amorphous on the other hand, It has the amorphous intrinsic-semiconductor layer 115 and the amorphous semiconductor layer 117 of an another side electric conduction format. The external cel 113 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 118 of an electric conduction format, the amorphous intrinsic-semiconductor layer 119, and the 2nd semi-conductor layer 122 of the microcrystal of an another side electric conduction format outside from inside. Moreover, this invention is drawing 20 . ** -- outside the internal cel 124 with the amorphous 1st semi-conductor layer 126 of an electric conduction format on the other hand in order from inside like It has the intrinsic-semiconductor layer 127 of a microcrystal, and the amorphous semiconductor layer 129 with an optical band gap are an another side electric conduction format and larger than the 1st semi-conductor layer. The external cel 125 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 130 of an electric conduction format, the amorphous intrinsic-semiconductor layer 131, and the 2nd semi-conductor layer 134 of the microcrystal of an another side electric conduction format outside from inside. If this invention is followed, a microcrystal (muc) semi-conductor layer can have high conductivity, and can improve photoelectric conversion efficiency by introducing such a microcrystal semi-conductor layer between the 1st semi-conductor layer and a pin junction

layer. While the heterojunction of the amorphous pin junction layer and 2nd semi-conductor layer can perform effective collection of an optical generation carrier, loss of recombination of an optical generation carrier is mitigable with an amorphous pin junction layer again. By receiving the reflected light by the inner surface of the crevice of a base material, temperature up is carried out to 40-80 degrees C, degradation of the photoelectric transfer characteristic is controlled by this, and the amorphous semiconductor is convenient. Since this optoelectric transducer is formed almost spherically, it will be controlled that the incidence energy of the light per [which receives direct light and the reflected light] unit area becomes large, and degradation of the photoelectric transfer characteristic will be controlled by this. Moreover, this invention is characterized by the 1st semi-conductor layer being a direct semiconductor layer. Moreover, this invention is characterized by a direct semiconductor layer being one kind chosen from the group who consists of InAs, GaSb, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe. If this invention is followed, the direct semiconductor layer which is easy to absorb light can realize the inside 1st semi-conductor layer, sufficient transition probability of an electron and an electron hole can be acquired by this, and photoelectric conversion efficiency can be improved also by this. Moreover, two or more base materials adjoin, this invention is arranged, and the periphery of each base material is extended and formed in the method of outside, and it is this periphery and is characterized by the thing for which the 1st conductor of a base material and the 2nd conductor of the base material of another side are connected electrically repeatedly while adjoining. Moreover, said each periphery starts, has a part or a falling part, and starts, and the part or falling part of this invention is characterized by connecting electrically repeatedly. If this invention is followed, by the periphery of two or more base materials with which the optoelectric transducer was carried, the 1st conductor of one base material and the 2nd conductor of the base material of another side can be connected in piles, and the high electrical potential difference which carries out the series connection of the photoelectromotive force by the optoelectric transducer for every base material, and wishes for it in this way can be taken out. As long as it follows this invention, it falls with the standup part of the periphery of a base material, and a part is connected electrically in piles, or you may make it connect standup parts or falling parts electrically, as shown in below-mentioned drawing 12 and below-mentioned drawing 13 . By this, the crevice of a base material can be approached and as many crevices and optoelectric transducers as possible can be arranged now in a limited area.

[Embodiment of the Invention] Drawing 1 is some expanded sectional views of the optical power plant 1 of one gestalt of operation of this invention, drawing 2 is the sectional view showing the configuration of the optical whole power plant 1, and drawing 3 is the decomposition perspective view of the optical power plant 1 shown in drawing 2 . The combination object 4 which consists of two or more optoelectric transducers 2 which have a fundamental almost spherical configuration, and the base material 3 with which that optoelectric transducer 2 is carried is laid underground in the packed bed 5 which consists of a translucency synthetic-resin ingredient, for example, PVB (polyvinyl butyral), EVA (ethylene vinyl acetate), etc., the translucency protection sheets 6, such as a polycarbonate, are arranged and the optical power plant 1 is fixed to this packed bed 5 at a light source side, such as sunlight. The protection sheet 6 of a packed bed 5 and the waterproof rear-face sheet 12 which changes from a synthetic-resin ingredient etc. to the front face of an opposite hand (lower part of drawing 1) are fixed. In this way, the configuration of the optical whole power plant 1 is tabular [flat]. An optoelectric transducer 2 has the 1st semi-conductor layer 7 and the 2nd semi-conductor layer 8 of the method of outside [it]. Opening 9 is formed in the 2nd semi-conductor layer 8. A part of 1st semi-conductor layer 7 10 is exposed under drawing 1 from opening 9. By irradiating light 11 from the upper part of drawing 1 , photoelectromotive force is outputted from between the 1st and 2nd semi-conductor layer 7 of an optoelectric transducer 2, and 8. An electric insulator 15 is sandwiched between the 1st conductor 13 and the 2nd conductor 14, in this way, the 1st and 2nd conductors 13 and 14 are electrically insulated through an electric insulator 15, and a base material 3 is constituted. The 1st and 2nd conductors 13 and 14 may be aluminium foil, and may be other metal sheets. Electric insulators 15 may be synthetic-resin ingredients, such as polyimide, and may consist of other electric insulation ingredients. Two or more crevices 17 of each are formed adjacently, and the inner surface of this crevice 17 is formed with the 1st conductor 13. An optoelectric transducer 2 is arranged at the bottom in each crevice 17, respectively. Drawing 4 is some top views of a base material 3. the opening edge 18 of a crevice 17 -- a polygon -- it is -- for example, -- the gestalt of this operation -- a swage block -- it may be forward six square shapes of a **, and you may be other polygons of three or more square shapes with other gestalten of operation of this invention, for example. In drawing 4 , the die length W1 of the opening edge 18 may be 2mm. Each opening edge 18 which adjoins mutually stands in a row in succession by the inverted-L-shaped flection [in / in a crevice 17 / drawing 1] 19. As many crevices 17 as possible can be formed in the area which attends light 11 by this, therefore the reflected light by the 1st conductor 13 of the inner surface of a crevice 17 can be reflected and led to an optoelectric transducer 2, and a condensing ratio can be enlarged. A crevice 17 is formed in parabolic in

'the shape of a taper, for example as it becomes a bottom. The 1st semi-conductor layer 7 of an optoelectric transducer 2 is electrically connected [at the bottom of a crevice 17] to the 2nd conductor 14 of a base material 3 in a connection 21. The 2nd semi-conductor layer 8 of an optoelectric transducer 2 is the bottom of a crevice, or its circumference, and is electrically connected to the 1st conductor 13 of a base material 3. Drawing 5 is the sectional view showing the optoelectric transducer 31 in the condition before being carried in the base material 3 of an optoelectric transducer 2. The optoelectric transducer 31 of drawing 5 has cross-section structure similar to above-mentioned drawing 1 . The 1st semi-conductor layer 7 is spherical, and consists of the n form Si. The 1st semi-conductor layer 7 may be amorphous one, a single crystal, or polycrystal. The 2nd semi-conductor layer 8 formed in a way outside this 1st semi-conductor layer 7 is the p form Si. This 2nd semi-conductor layer 8 may be amorphous one, a single crystal, or polycrystal. If this 2nd semi-conductor layer 8 takes a large optical band gap rather than the 1st semi-conductor layer 7, p form a-SiC, then a wide gap aperture operation will be attained, for example. With other gestalten of operation of this invention, the 1st semi-conductor layer 7 shown in drawing 5 may be one kind chosen from the group who consists of InAs which is realized by the direct semiconductor layer, for example, has n form electric conduction format, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe. The 2nd semi-conductor layer 8 is formed on the 1st semi-conductor layer 7 formed of this direct semiconductor layer, and this 2nd semi-conductor layer 8 is one kind chosen from the group of a compound semiconductor similar to Semi-conductor AlGaAs and CuInSe2 which have p form electric conduction format, Cu(InGa) Se2, GaAs, AlGaP, CdTe, or it. In this way, pn junction structure is formed. Like below-mentioned drawing 6 , between the 1st semi-conductor layer 68 and the 2nd semi-conductor layer 70, i semi-conductor layer 69 is formed and pin junction structure may be formed of this at the process which uses an amorphous semiconductor for the 1st and 2nd semi-conductor layers 7 and 8. How to manufacture the combination object 4 with the base material 3 shown in drawing 1 is explained below using the optoelectric transducer 31 shown in drawing 5 . Drawing 6 is a sectional view for explaining how to manufacture the combination object 4 which has an optoelectric transducer 2 and a base material 3. After the spherical optoelectric transducer 2 shown in above-mentioned drawing 5 is manufactured, as shown in drawing 6 , cutting of the optoelectric transducer 2 is carried out. In the optoelectric transducer 2 shown in drawing 6 , a part of 1st semi-conductor layer 7 10 is exposed from the opening 9 of the 2nd semi-conductor layer 8. As for this opening 9, the central angle theta 1 is formed in a plane in less than 180 degrees. The central angle theta 1 may be 45-90 degrees, and may be 60-90 degrees preferably. The outer diameter D1 of an optoelectric transducer 31 may be for example, under 0.5-2mmphi, and is 0.8-1.2mmphi still more preferably. The bore of opening 9 is shown by the reference mark D2. Condensing ratio x=S1/S2 is two to 8 times, and is four to 6 times preferably. Drawing 7 is a sectional view for explaining the process which carries out cutting of the spherical optoelectric transducer 31, and forms opening 9. Vacuum attraction of the upper part is carried out with the attraction pad 34, respectively, and two or more spherical optoelectric transducers 31 are ground with the endless belt-like abrasives 35. Revolution actuation of the abrasives 35 is wrapped and carried out over rollers 36 and 37. It is drawing 6 again. It refers to, the 1st conductor 13 of aluminium foil is prepared in manufacture of a base material 3, and the connection hole 39 is formed in this 1st conductor 13. The bore D3 of the connection hole 39 is less than one outer diameter D of an optoelectric transducer 2, and is chosen as the value exceeding the bore D2 of the opening 9 of the 2nd semi-conductor layer 8 (D1>D3> D2). The sheet metal-like electric insulator 15 is prepared and the connection hole 40 is formed in this electric insulator 15. The bore D4 of the connection hole 40 is less than two bore D of the opening 9 of an optoelectric transducer 2 (D2> D4). In this way, the 1st conductor 13 which has the connection hole 39, and the electric insulator 15 which has the connection hole 40 pile up and paste up, and is unified, and each axis of these connection holes 39 and 40 exists on a straight line. Furthermore, the 2nd conductor 14 piles up and pastes up, and is unified, and flat base material 3a is formed. With other gestalten of operation of this invention, the 1st conductor 13 which has the connection hole 39, the electric insulator 15 which has the connection hole 40, and the 2nd conductor 14 pile up simultaneously, paste up, and may be unified. The thickness of the 1st and 2nd conductors 13 and 14 and an electric insulator 15 may be 60 micrometers. Near [opening 9] an optoelectric transducer 2 fits into the connection hole 39, and the connection hole 40 of an electric insulator 15 is faced it. The connection hole 39 is faced said opening 9 neighborhood, and it may be placed on the 1st conductor 13. Drawing 1 is also referred to collectively and the part which surrounds the 1st connection hole 39 the peripheral face which surrounds the opening 9 of the 2nd semi-conductor layer 8 rather than the opening 9 of an optoelectric transducer 2 in the upper part of drawing 1 , the inner skin of the part 39 of 1st connection hole 39 near [the 1st conductor 13 of base materials 3a or 3], i.e., the 1st connection hole, or near [1st connection hole 39] the is connected electrically. The amount of [of the peripheral face of the 2nd semi-conductor layer 8 and the 1st conductor 13 / 44 (refer to drawing 1)] connection It is located in an opposite hand (upper part of drawing 1) in the 1st conductor 13 rather than the periphery section 45 of the virtual flat surface containing opening 9. It prevents

certainly the 1st conductor 13 flowing electrically with the 1st conductor 7 by this, and exists in an opening 9 side (lower part of drawing 1) rather than the virtual flat surface 47 which is parallel to the virtual flat surface containing opening 9 as for a part for this connection 44, and passes along the core 46 of an optoelectric transducer 2. Then, plastic deformation processing of the flat base material 3a is carried out with a press, and two or more crevices 17 adjoin and are formed. The 2nd conductor 14 deforms so that a projection 40, i.e., a connection hole, may be inserted in above drawing 6 and it may upheave from the connection hole 40 of an electric insulator 15, and a connection 21 is formed. In this way, the height H1 of the formed base material 3 may be about 1mm. Any may be first performed on a target one by one, or the electrical installation process of the 1st semi-conductor layer 7 and the 2nd conductor 14 and both the processes with the electrical installation process of the 2nd semi-conductor layer 8 and the 1st conductor 13 may be performed simultaneously again. In this way, the optoelectric transducer 2 which has opening 9 in the formed crevice 17 is arranged. With other gestalten of operation of this invention, after carrying out plastic deformation processing of the three-tiered structure of the 13/insulator 15 of conductors/a conductor 14 so that a crevice 17 may be formed, each above-mentioned openings 39 and 40 may be formed in a conductor 13 and an insulator 15 using two kinds of each laser beam, respectively, and a base material 3 may be manufactured. Drawing 8 is the simplified perspective view showing the process which arranges an optoelectric transducer 2 in the crevice 17 of a base material 3. The optoelectric transducer 2 by which cutting was carried out where vacuum attraction is carried out with the attraction pad 34 in above-mentioned drawing 7 is conveyed and arranged in the crevice 17 of a base material 3 with the position which the opening 9 faced caudad. Two or more, 100 pieces and a train are accomplished and the attraction pad 34 is formed. After the optoelectric transducer 2 has been arranged in a crevice 17 with the attraction pad 34, only one pitch of a crevice 17 is moved to a travelling direction 42, and a base material 3 arranges an optoelectric transducer 2 to the new crevice 17 using the attraction pad 34 like the above-mentioned. Such actuation is repeated and an optoelectric transducer 2 is arranged in all the crevices 17. Then, an optoelectric transducer 2 is electrically connected to a base material 3 at the bottom of a crevice 17. It exposes by opening 32 and the 1st semi-conductor layer 7 of an optoelectric transducer 2 is electrically connected to a connection 21 with the connection hole 40 of the 2nd conductor 14. Moreover, as for the 2nd semi-conductor layer 8 of an optoelectric transducer 2, the periphery section of the upper part of opening 9 is connected to the part and the electric target of the connection hole 39 neighborhood of the 1st conductor 13. Each electric connection with these 1st and 2nd conductors 13 and 14 and 2nd and 1st semi-conductor layers 8 and 7 of an optoelectric transducer 2 may be electrically connected using a metal bump using a laser beam, using an eutectic or a conductive paste. In this way, without using the solder containing lead, electrical installation can be performed and it is desirable from a viewpoint of environmental protection. Drawing 9 is the perspective view showing the condition that the combination objects 4 and 4b which have an optoelectric transducer 2 and a base material 3 were connected. Electric connection is made by the plane peripheries 61 and 61b prolonged in a way outside the combination objects 4 and 4b. Drawing 10 is the periphery 61 of the combination objects 4 and 4b shown in drawing 9 , and a decomposition sectional view near 61b. On the 1st conductor 13 of the base material 3 of one combination object 4, it connects electrically repeatedly and the 2nd conductor 14 of base material 3b of another side is fixed. In this way, the high electrical potential difference which carries out the series connection of the photoelectromotive force by two or more base materials 3 and the optoelectric transducer 2 of every 3b, therefore he wishes can be taken out. Drawing 11 is the simplified side elevation showing the condition of having connected electrically the combination objects 4, 4b, and 4c. While adjoins and periphery 61of combination object 4b of another side b is electrically connected on the periphery 61 of the combination object 4, or to the bottom as mentioned above in piles. Furthermore, the above-mentioned periphery 61b of combination object 4b and the periphery 61b1 of an opposite hand are put on periphery 61of adjoining combination object 4c c up and down, and are electrically connected to it. With the configuration arranged as one periphery 61b of combination object 4b is shown in drawing 11 under the periphery 61b of the combination object 4, the periphery 61b1 of another side is arranged in the upper part of periphery 61c of combination object 4c, so to speak, is together put up and down by turns in the shape of two step in this way, and is connected. The die length L61 with which the longitudinal direction in a periphery 61, 61b;61b1, and drawing 11 of 61c lapped may be 1mm. drawing 12 It is the sectional view showing the electric connection structure of the combination objects 4 and 4b which ** and adjoin. The periphery 61 of one combination object 4 has started, and periphery 61of combination object 4b of another side b falls, and is formed. The conductor 14 in a periphery 61 and the conductor 13 of periphery 61b are connected electrically. Drawing 13 is the sectional view showing the electrical installation condition of the combination objects 4 and 4b in other gestalten of operation of this invention. Although the gestalt of this operation is similar to the gestalt of operation of drawing 12 , with the gestalt of this operation, the conductor 13 of a periphery 61 with which the combination object 4 started is especially connected to the conductor 14 of

periphery 61b with which combination object 4b fell electrically. According to such drawing 12 and the connection structure of drawing 13 , the crevice of base materials 3 and 3b can be approached, and as many crevices and optoelectric transducers as possible can be arranged now in a limited area. Drawing 14 is some sectional views of the optoelectric transducer 2 of other gestalten of operation of this invention. each semi-conductor layer is shown by the flat configuration developed to the hoop direction at drawing 14 and below-mentioned drawing 15 - drawing 20 -- also although kicked, actually, a laminating is carried out to the shape of radii one by one toward the upper part at a target from the lower part from the method of the inside of radial to the method of outside, i.e., each drawing, and it has the spherical surface and is formed. In drawing 14 , it has the configuration which has the n form microcrystal (muc) Si layer 63 and the double heterojunction layer of the n form polycrystal (poly) Si layer 64/p form a-SiC layer 65/p form microcrystal SiC layer 66 on a target one by one toward the method of outside from the method of the inside of radial of an optoelectric transducer. The configuration of the optoelectric transducer which has such pn junction is shown in a table 1.

[A table 1]

図	参照符	層
14	66	p μc−SiC
	65	p a−SiC
	64	n poly Si
	63	n μc−Si
15	70	p a−SiC
	69	i a−SiC
	68	n μc−Si
16	77	p μc−SiC
	76	p a−SiC
	75	i a−SiC
	74	i a−Si
	73	n μc Si

Drawing 15 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. Each semi-conductor layers 68, 69, and 70 have the configuration of the above-mentioned table 1. With other gestalten of operation of this invention, Si of the single crystal of n form or polycrystal may be used as a semi-conductor layer 68 in the optoelectric transducer 2 of drawing 15 . Drawing 16 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. The concrete configuration of each semi-conductor layer is as being shown in the above-mentioned table 1. With other gestalten of operation of this invention, the semi-conductor layers 73 and 74 in this drawing 16 may be n form crystals Si. Moreover, the semi-conductor layer 74 may be i form microcrystal Si. Drawing 17 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. The optoelectric transducer 2 of drawing 17 - drawing 20 has the stack structure of 2 junction. With other gestalten of operation of this invention, the optoelectric transducer 2 which has the stack structure of 3 or more ****s may be used. The concrete configuration of each optoelectric transducer 2 of drawing 17 - drawing 20 is as being shown in a table 2.

[A table 2]

図		参照符	層
17	外部セル 82	87	a－SiC
		86	a－Si pin
	内部セル 81	85	p a－Si
		84	n poly－Si
18	外部セル 102	111	p μc－SiC
		110	p a－SiC
		109	i a－SiC
		108	i a－Si
		107	n μc－Si
	内部セル 101	106	p μc－SiC
		105	p a－SiC
		104	n poly－Si
		103	n μc－SiC
19	外部セル 113	122	p μc－SiC
		121	p a－SiC
		120	i a－SiC
		119	i a－Si
		118	n μc－Si
	内部セル 112	117	p a－SiC
		116	i a－SiC
		115	i a－Si
		114	n a－SiC
20	外部セル 125	134	p μc－SiC
		133	p a－SiC
		132	i a－SiC
		131	i a－Si
		130	n μc－Si
	内部セル 124	129	p a－SiC
		128	i a－Si
		127	i μc－Si
		126	n a－Si

In drawing 17 , the external cel 82 is formed in a way outside the internal cel 81. The semi-conductor layer 84 may be n form amorphous silicon, the semi-conductor layer 85 may be p form microcrystal Si, and the semi-conductor layer 87 may be Microcrystal SiC further. At a target the pin junction layer of the semi-conductor layer 86 from the method of the inside of radial of an optoelectric transducer 2 one by one to the method of outside p form, Although the laminating of each semi-conductor layer of i form and n form may be carried out and it may be constituted, with other gestalten of operation of this invention The electric conduction format of the semi-conductor layers 84 and 85 of the internal cel 81 is made into reverse with drawing 17 , and the electric conduction format of the semi-conductor layers 86 and 87 of the external cel 82 is made into reverse with drawing 17 . In this semi-conductor layer 86 The semi-conductor layer of n form, i form, and p form may be formed in a target one by one, it is as above-mentioned and this has it about the optoelectric transducer 2 equipped with the pin junction layer which has other configurations. [same] Drawing 18 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. To the internal cel 101 and the external cel 102, the laminating of semi-conductor layer 103-106;107-111 is carried out, and they are constituted. Drawing 19 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. To the internal cel 112 and the external cel 113, the laminating of semi-conductor layer 114-117;118-122 is carried out, and they are constituted. It may replace with the semi-conductor layer 117, and you may be p form amorphous silicon O. The semi-conductor layer 121 may be p form amorphous silicon O similarly. Drawing 20 is the sectional view of the optoelectric transducer 2 of the gestalt of the operation of further others of this invention. As for the internal cel 124 and the external cel 125, semi-conductor layer 126-129;130-134 are formed. It replaces with the semi-conductor layer 129, and p form amorphous silicon O may be used. The optoelectric transducer 2 of this invention may have configurations other than the above-mentioned configuration. With other gestalten of operation of this invention, it replaces with a base material 3, for example, conductive ingredients,

such as nickel, may be plated on the front face, the 1st and 2nd conductors may be formed [a crevice may be formed with shaping of injection molding, such as electric insulation synthetic-resin ingredients, such as a polycarbonate, etc.,] in it, and a base material may be manufactured. Although the 1st and 2nd conductors may be aluminium foil, they may be formed of Cr plating or Ag plating, and may form these metals nickel, Cr, aluminum, and Ag etc. by vacuum evaporationo or the spatter further. An enveloping layer may be formed on the 1st conductor, and this enveloping layer may be metal formed of plating etc., or may be a product made of synthetic resin.

[Effect of the Invention] According to this invention, the amount of the ingredient of an optoelectric transducer and especially expensive Si used is reduced substantially, the number of optoelectric transducers is decreased further, the connection routing of an optoelectric transducer and a base material is simplified, it does in this way, productivity improves, and the cost price is reduced. By using especially the optoelectric transducer of this invention, it is realizable by the manufacture approach of saving resources and an energy-saving form. The reflected lights, such as sunlight by the 1st conductor which forms the inner surface of the crevice of a base material, or its enveloping layer, are irradiated at an optoelectric transducer, and light can be used effectively. It connects with the 2nd semi-conductor layer of an optoelectric transducer, and the 1st conductor or its enveloping layer achieves the work which draws a current while achieving the work which reflects light. The configuration of such a base material is simple and productivity is excellent. according to especially this invention -- the outer diameter of an optoelectric transducer -- 0.5-2mmphi, while choosing it as 0.8-1.2mmphi preferably The effectiveness which stood high that the amount of Si used of per generating power 1W and the number which needs an optoelectric transducer can be sharply decreased to 1 / 5 - 1/10 compared with the 3rd above-mentioned advanced technology 2-8, and by choosing it as 4-6 preferably in the condensing ratio x can be attained now. While an optical power plant is cheaply realizable by reducing the amount of Si used, the number of optoelectric transducers will be decreased, the electric connection routing of an optoelectric transducer and a base material will be simplified, productivity will improve in this way, and a cheap optical power plant will be realized by this. Therefore, high-reliability and an efficient optical power plant can be offered now. According to this invention, the optical band gap of the outside amorphous 2nd semi-conductor layer is made larger than the 1st semi-conductor layer by the side of a core, pn junction or a pin junction is constituted, by this, it prevents from absorbing light in the 2nd semi-conductor layer of the aperture ingredient by the side of the incidence of light, recombination by the surface layer can be reduced, a wide gap aperture operation can be attained, and improvement in photoelectric conversion efficiency can be aimed at. Moreover, according to this invention, improvement in an energy conversion efficiency can be aimed at by intervening the high microcrystal (muc) semi-conductor layer of conductivity between the 1st semi-conductor layer by the side of a core, and the pin junction layer of the method of outside [it]. Moreover, according to this invention, it is also possible to improve an energy conversion efficiency using the transited [directly] type 1st semi-conductor layer. Moreover, according to this invention, manufacture of an optoelectric transducer is easy.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to an optical power plant. A pin junction must be interpreted as a thing including the configuration by which each semi-conductor layer of n form, i form, and p form was formed one by one in outside [from] or inside from outside at the target among almost spherical optoelectric transducers among this description.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The 1st typical advanced technology contains the optoelectric transducer which consists of a crystal silicon semi-conductor wafer. In this 1st advanced technology, the process for manufacturing a crystal is complicated and costs become high. Moreover, since a semi-conductor wafer is manufactured through processes, such as cutting, slicing, and polishing, from single crystal bulk, a process is complicated, and the cut waste of the crystal further produced at processes, such as the cutting, slicing, and polishing, makes it a capacity factor, becomes about 50% or more, and becomes useless. Other 2nd advanced technology which solves this problem consists of an amorphous silicon (abbreviated-name a-Si) thin film. Since this 2nd advanced technology forms a photo-electric-translation layer by the shape of a thin film by plasma chemistry vapor growth, its processes, such as cutting from the single crystal bulk of the conventional technique, slicing, and polishing, are unnecessary, and it has the advantage that all the deposited film can be used as a barrier layer of a component. On the other hand, it originates in amorphous structure, and many crystal defects, i.e., gap States, exist in the interior of a semi-conductor, therefore an optical induction degradation phenomenon exists, and an amorphous silicon solar battery has the problem that photoelectric conversion efficiency falls. In order to solve this problem, in the former, the technique inactivated by the hydrogen treating is developed and manufacture of electron devices, such as an amorphous silicon solar battery, is attained. However, also by such processing, it is impossible to abolish the effectiveness of a crystal defect, for example, the weak point that photoelectric conversion efficiency deteriorates about 15 to 25% is still held in the amorphous silicon solar battery. The stack form solar battery which makes i layers of photoelectrical activity extremely thin, and makes a photovoltaic cell 2 junction or 3 junction as a new technique which controls the photodegradation in which it succeeded recently was realized, and it has succeeded in controlling photodegradation to about 10%. Although the module technique of it becoming clear photodegradation being recovered, and operating/working in such the condition is also being developed when this photodegradation has a high operating temperature of a photovoltaic cell, it is hard to say that it is enough. Other 3rd advanced technology is indicated by the pan which solves such a problem at JP,7-54855,B. The n form Si epidermis section is etched into the flat aluminium foil with which the hole opened the spherical particle which has the n form Si epidermis section in a p form Si ball from the rear face of a pad and its aluminium foil, an internal p form Si ball is exposed, this exposed p form Si ball is connected to another aluminium foil, and a solar array consists of this 3rd advanced technology. It is necessary to mitigate the amount of Si used of a high grade, to make small a drawing wax, then the outer diameter of a particle for reduction of the cost price, and to make the whole average thickness thin in this 3rd advanced technology. Moreover, the particle of a large number which need to enlarge a light-receiving side in order to aim at improvement in conversion efficiency, approach mutually, arrange a particle in order to enlarge the light-receiving side, therefore have a small outer diameter must be arranged densely, and must be connected to aluminium foil. Consequently, the connection routing of a particle and aluminium foil becomes complicated, and it is inferior to reduction of the cost price.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the amount of the ingredient of an optoelectric transducer and especially expensive Si used is reduced substantially, the number of optoelectric transducers is decreased further, the connection routing of an optoelectric transducer and a base material is simplified, it does in this way, productivity improves, and the cost price is reduced. By using especially the optoelectric transducer of this invention, it is realizable by the manufacture approach of saving resources and an energy-saving form. The reflected lights, such as sunlight by the 1st conductor which forms the inner surface of the crevice of a base material, or its enveloping layer, are irradiated at an optoelectric transducer, and light can be used effectively. It connects with the 2nd semi-conductor layer of an optoelectric transducer, and the 1st conductor or its enveloping layer achieves the work which draws a current while achieving the work which reflects light. The configuration of such a base material is simple and productivity is excellent. according to especially this invention -- the outer diameter of an optoelectric transducer -- 0.5-2mmphi, while choosing it as 0.8-1.2mmphi preferably The effectiveness which stood high that the amount of Si used of per generating power 1W and the number which needs an optoelectric transducer can be sharply decreased to 1 / 5 - 1/10 compared with the 3rd above-mentioned advanced technology 2-8, and by choosing it as 4-6 preferably in the condensing ratio x can be attained now. While an optical power plant is cheaply realizable by reducing the amount of Si used, the number of optoelectric transducers will be decreased, the electric connection routing of an optoelectric transducer and a base material will be simplified, productivity will improve in this way, and a cheap optical power plant will be realized by this. Therefore, high-reliability and an efficient optical power plant can be offered now. According to this invention, the optical band gap of the outside amorphous 2nd semi-conductor layer is made larger than the 1st semi-conductor layer by the side of a core, pn junction or a pin junction is constituted, by this, it prevents from absorbing light in the 2nd semi-conductor layer of the aperture ingredient by the side of the incidence of light, recombination by the surface layer can be reduced, a wide gap aperture operation can be attained, and improvement in photoelectric conversion efficiency can be aimed at. Moreover, according to this invention, improvement in an energy conversion efficiency can be aimed at by intervening the high microcrystal (muc) semi-conductor layer of conductivity between the 1st semi-conductor layer by the side of a core, and the pin junction layer of the method of outside [it]. Moreover, according to this invention, it is also possible to improve an energy conversion efficiency using the transited [directly] type 1st semi-conductor layer. Moreover, according to this invention, manufacture of an optoelectric transducer is easy.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] It reduces the amount of the semiconductor materials used, such as Si of a high grade, and moreover the object of this invention is easy to mass-produce, that is, is offering the high-reliability which enables manufacture of saving resources and an energy-saving form, and is realized cheaply, and an efficient optical power plant.

[Translation done.]

MEANS

[Means for Solving the Problem] Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It is the optical power plant characterized by connecting with the 2nd semi-conductor layer of an optoelectric transducer electrically, and the 2nd conductor containing the base material electrically connected to said exposed part of the 1st semi-conductor layer. If this invention is followed, two or more almost spherical optoelectric transducers of each will be arranged in two or more crevices of each of a base material, respectively. The inner surface of this crevice It is formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor, therefore it is reflected by the 1st conductor or the enveloping layer formed upwards the 1st conductor of a crevice inner surface, and the light from the outside, such as sunlight, is irradiated by the optoelectric transducer while it is directly irradiated by the optoelectric transducer. Since an optoelectric transducer is arranged in a crevice, spacing is opened mutually, and it is prepared in it, namely, an optoelectric transducer is not arranged densely. Therefore, while being able to reduce the amount of the ingredients used, such as the high grade which decreases the number of an optoelectric transducer and constitutes an optoelectric transducer, for example, Si etc., the connection process of an optoelectric transducer and the conductor of a base material can be made easy. And two or more crevices are adjoined and formed mutually, by this, it reflects by the crevice inner surface, the light from the outside irradiates an optoelectric transducer, and the light from the outside can be effectively used for it for generating of the photoelectromotive force of an optoelectric transducer. In this way, generated output per [which faces the light source of the optoelectric transducer of this invention] unit area can be enlarged as much as possible. You may change from a single crystal, polycrystal, or an amorphous ingredient to the optoelectric transducer of this invention, and may change from the ingredient of a silicon system, a compound semiconductor system, and others to it, may have each structure of pn form and a pin form, in addition may have the configuration of for example, a shot key barrier form, an MIS (metal-insulator-semiconductor) form, a gay junction type, a heterojunction form, and others. It has exposed selectively from opening of the outside 2nd semi-conductor layer, and the 1st semi-conductor layer by the side of a core can take out the photoelectromotive force generated at the time of an optical exposure from between these 1st and 2nd semi-conductor layers. The 2nd semi-conductor layer of the optoelectric transducer arranged in the crevice of a base material is electrically connected to the 1st conductor of a base material. The exposed part of the 1st semi-conductor layer inside an optoelectric transducer is electrically connected with the 1st conductor at the 2nd conductor prepared through the electric insulator. With the structure where the 1st conductor and the 2nd conductor are formed in the shape of a field, with these 1st and 2nd conductors, parallel connection of two or more optoelectric transducers is carried out, and they can derive a big current. Although an optoelectric transducer may be a real ball, even if it is not a real ball, if the outside surface is [other than a real ball] almost spherical, it is good. The 1st semi-conductor layer may have the configuration near [whose] the core of the again almost spherical 1st semi-conductor layer you may be the configuration that the 1st semi-conductor layer was covered and formed in the peripheral face of the axis prepared beforehand, or is a cavity with other gestalten of operation of this invention, although a solid may be formed almost spherically. Moreover, this invention is characterized by the outer diameter of an optoelectric transducer being 0.5-2mmphi. As long as it

follows this invention, the outer diameter of an optoelectric transducer may be 0.5-2mmphi, and may be 0.8-1.2mmphi preferably, or may be about 1mmphi again. While lessening enough the amount of the ingredients used, such as Si of a high grade, and being able to enlarge generating power now as much as possible moreover by this, handling of the spherical optoelectric transducer at the time of manufacture is easy, and productivity is excellent. Moreover, this invention is characterized by the central angle theta 1 of opening of said 2nd semi-conductor layer being 45-90 degrees. If this invention is followed, by choosing the central angle theta 1 as 60-90 degrees still more preferably by choosing it as 45-90 degrees as mentioned above, the 1st and 2nd semi-conductor layer can reduce the amount discarded by formation of said opening, and can control futility. And the area of opening required for the electrical installation of the 1st semi-conductor layer and the 2nd conductor of a base material can be obtained by choosing the central angle theta 1 as the range of such a value. Moreover, the opening edge of the crevice where this invention was formed in the base material For example, each opening edge which is the polygon of the shape of a blow hole of a bee, and adjoins mutually Continuously, a crevice is formed in the shape of a taper as it becomes a bottom, it is the bottom of a crevice, or its circumference, and is characterized by connecting with the 2nd and 1st conductors with which the 1st and 2nd semi-conductor layer of an optoelectric transducer is insulated electrically mutually electrically, respectively. This invention is the bottom of the crevice of a base material, or its circumference. Moreover, to the 1st conductor While the circular 1st connection hole 39 is formed, to an electric insulator The circular 2nd connection hole 40 which has an axis is formed on the straight line containing the axis of the 1st connection hole 39. Near [said] opening of an optoelectric transducer It fits into the 1st connection hole 39, the peripheral face of the upper part of opening of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part near an end face is connected electrically, said part of the 1st semi-conductor layer exposed from said opening minds the 2nd connection hole 40, and it is the 2nd conductor. It is characterized by being alike and connecting electrically. Moreover, when this invention sets the outer diameter of an optoelectric transducer to D1, the bore of opening of said 2nd semi-conductor layer is set to D2, the bore of the 1st connection hole 39 is set to D3 and the bore of the 2nd connection hole 40 is set to D4, it is characterized by choosing it as D1>D3>D2>D4. If this invention is followed, said a part of 1st semi-conductor layer which near [said] opening of an optoelectric transducer fitted into the 1st connection hole 39 of the 1st conductor, and was exposed to it from the opening will be electrically connected to the 2nd conductor through the 2nd connection hole 40 formed in the electric insulator of a base material. The 1st and 2nd conductors of the base material which has the 1st conductor, an electric insulator, and the 2nd conductor by this can be easily connected now to the 2nd and 1st semi-conductor layer and the electric target of an optoelectric transducer, respectively. The part which surrounds the 1st connection hole 39 rather than the opening 9 of below-mentioned drawing 1 in the upper part the inner skin of the peripheral face of the upper part of the opening 9 of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part 39 near an end face, i.e., the 1st connection hole, and/or near [1st connection hole 39] the is electrically connected about the electrical installation of the 2nd semi-conductor layer and the 1st conductor. the conductive paste which upheaved, plastic deformation could be carried out, and could be connected [the 2nd conductor 14 could insert the 2nd connection hole 40 in the part 10 exposed from the opening 9 of the 1st semi-conductor layer 7, for example,] electrically, or was prepared in the 2nd connection hole 40 -- or conductive bumps, such as a metal, etc. may connect with the 2nd conductor 14 electrically. Moreover, by choosing these outer diameter D1 and bores D2, D3, and D4 as the above-mentioned inequality, an electric short circuit [**** / un-] is prevented and positive electrical installation becomes possible. Moreover, this invention is characterized by choosing condensing ratio x=S1/S2 as 2-8, when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2. Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. moreover, this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer It is 0.5-2mmphi, and when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core

of an optoelectric transducer to S2, it is the optical power plant characterized by choosing condensing ratio x=S1/S2 as 2-8. Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. moreover, this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer It is 0.8-1.2mmphi, and when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2, it is the optical power plant characterized by choosing condensing ratio x=S1/S2 as 4-6. if this invention is followed -- the opening edge of the crevice of a base material -- for example, a swage block -- it may be the polygon of a **, for example, you may be a hexagon, and this crevice is formed in the shape of a taper as it becomes a bottom, and an optoelectric transducer arranges it at that bottom -- having -- that optoelectric transducer -- the bottom of a crevice, or its circumference -- it is -- a base material -- each -- it connects with a conductor. The opening edge of a crevice is a polygon, and when each opening edge continues, all the carrier beam light can be irradiated at an optoelectric transducer the whole surface other than the location of the optoelectric transducer in the base material which faces the light sources, such as sunlight. Therefore, so to speak, a condensing form optoelectric transducer is [condensing ratio x=S1/S2] preferably realizable as two to 8 times as four to 6 times. Mutual spacing of an optoelectric transducer can be enlarged as mentioned above by this, and the number of an optoelectric transducer can be decreased, and an electric connection routing with a base material can be simplified. Therefore, the amount of the high grade semi-conductor used used as the ingredient of an optoelectric transducer can be decreased, and this invention can be cheaply carried out now. It is comparatively easy, and the configuration of a base material is excellent in productivity, and easy to manufacture. for example, according to the experiment of this artificer, with this light power plant formed so that the outer diameter might be set to 800-1000 micrometerphi, the optoelectric transducer which consists of almost spherical Si Si of the same weight as Si which constitutes all the optoelectric transducers used with four to 6 times, then an optical power plant in the condensing ratio x The thickness when converting into the plate which has an area equal to the projected area to a virtual flat surface vertical to a beam of light from the light source to an optical power plant on imagination It is set to about 90-120 micrometers, therefore the epoch-making result that the amount of Si used of per generating power 1W can be managed with the value of less than 2g can be obtained. With the 1st advanced technology of the optoelectric transducer which consists of the above-mentioned crystal silicon semi-conductor wafer, it is the thickness of crystal silicon. It is ** and 350-500 micrometers, and it will be set to about 1mm if a slice loss is included. Therefore, in the 1st advanced technology, the amount of Si used of per generating power 1W is about abbreviation 15-20g. Therefore, in this invention, the amount of Si used is substantially mitigable compared with the 1st above-mentioned advanced technology. The condensing ratio x can decrease the value exceeding 8, then the number which needs an optoelectric transducer, and can mitigate further the amount of Si used of per generating power 1W, but on the other hand actually, with the increment in the condensing ratio x, the condensing effectiveness which is a ratio to the light energy absorbed by the optoelectric transducer of the light energy by which incidence was carried out to the crevice will worsen, consequently performance degradation will be caused. If this invention is furthermore followed, while choosing the outer diameter of an optoelectric transducer as 0.5-2mmphi and choosing it as 0.8-1.2mmphi preferably as above-mentioned While being able to decrease the number of optoelectric transducers and being able to mitigate the amount of Si used of per generating power 1W by choosing the condensing ratio x as 2-8, and choosing it as 4-6 preferably, the electric connection routing of an optoelectric transducer and a base material can be simplified further. Thus, the combination with numerical selection of the outer diameter of an optoelectric transducer is important in order to decrease the number of optoelectric transducers and to reduce the amount of Si used of per generating power 1W. With the configuration with which the number which needs an optoelectric transducer increases, and the outer diameter exceeds 2mmphi although the outer diameter of an optoelectric transducer reduces the amount of Si used under by 0.5mmphi, although the number which needs an optoelectric transducer decreases, the amount of Si used will increase. If the condensing ratio x cannot reduce the amount of Si used enough and exceeds 8 less than by two, condensing effectiveness will get worse to less than 80%, and it will

result in causing performance degradation. In this invention, by choosing the condensing ratio x as the range of the above-mentioned value, condensing effectiveness can be made into 80% or more, and it can be 90 more% or more now. In this way, if this invention is followed, the outer diameter and the condensing ratio x of an optoelectric transducer will be chosen as the above-mentioned range of number, and the effectiveness which stood high that each of numbers which need an optoelectric transducer, and amount of Si used of per generating power 1W can be sharply decreased to 1 / 5 - 1/10 compared with the 3rd above-mentioned advanced technology by this will be attained. Moreover, with the configuration which condensed by the above-mentioned condensing ratio using the amorphous silicon optoelectric transducer according to this invention, the temperature of an optoelectric transducer is raised compared with the optoelectric transducer of amorphous silicon sheet metal, for example, can be made into 40-80 degrees C. It is possible to control degradation of an amorphous silicon optoelectric transducer and to make it long lasting by this. Moreover, an optoelectric transducer is characterized by forming in a way the 2nd semi-conductor layer 65 of the another side electric conduction format that an optical band gap is larger than the 1st semi-conductor layer, outside the 1st semi-conductor layer 64 of an electric conduction format, and on the other hand, having pn junction like drawing 14 in this invention. Moreover, on the other hand, an optoelectric transducer is characterized by forming the amorphous intrinsic-semiconductor layers 69 and 74 and the amorphous 2nd semi-conductor layers 70 and 76 of an another side electric conduction format with an optical band gap larger than the 1st semi-conductor layer in this sequence at a way, and having a pin junction outside the 1st semi-conductor layers 68 and 73 of an electric conduction format like drawing 15 and drawing 16 in this invention. Moreover, the 1st semi-conductor layer of this invention is the n form Si, and the 2nd semi-conductor layer is characterized by being p form amorphous silicon C. Moreover, it is characterized by the n form Si where this invention is the 1st semi-conductor layer being n form crystal Si or n form microcrystal (muc) Si. If this invention is followed, an amorphous semiconductor of a different kind constitutes the heterojunction aperture structure of pn or pin. The optical band gap of the 2nd semi-conductor layer of the aperture ingredient which exists in the incidence side of light It is made larger than the inside 1st semi-conductor layer, and the optical absorption multiplier of the 2nd semi-conductor layer is made small, and light is made not to be absorbed in this 2nd semi-conductor layer by this. Recombination with the electron in a surface layer and an electron hole is reduced, optical absorption loss is mitigated, and the sensibility by the side of short wavelength can be increased, and a wide gap aperture operation can be attained, consequently an energy conversion efficiency can be improved. While leading more light energies to the intrinsic-semiconductor layer (i layers) which is especially a photoelectromotive-force generating layer with pin junction structure, the sensibility by the side of short wavelength is increased, and a wide gap aperture operation can be attained. In this invention, energy conversion actuation which was extremely excellent in the way compared with the particle in which the n form Si epidermis section was formed, outside the p form Si ball in the above-mentioned advanced technology will be performed. Light is absorbed, an electron and an electron hole pair are made from i layers of an optoelectric transducer which have a pin junction, the duty which generates and conveys a photocurrent is achieved, and p layers and n layers fix Fermi level near a valence band and the conduction band, and achieve the duty which makes the internal field which carries the electron generated in i layers, and an electron hole to two electrodes, and collects optical generation carriers. In this way, improvement in an energy conversion efficiency is achieved. Moreover, an optoelectric transducer is characterized by having stack form structure like drawing 17 in this invention including the internal cel 81 which has the 1st semi-conductor layer of the method of the innermost, and the external cel 82 which is formed in a way outside the internal cel, and has the 2nd semi-conductor layer of the outermost direction. Moreover, the internal cel 81 is characterized by for this invention having a pn junction layer or a pin junction layer, and the external cel 82 having a pn junction layer or a pin junction layer. Moreover, on the other hand, this invention has the 1st semi-conductor layer 84 of an electric conduction format, and amorphous and/or the semi-conductor layer 85 of a microcrystal of an another side electric conduction format in order outside from inside, and, as for the internal cel 81, the external cel 82 is characterized by the thing with a large optical band gap for which it has amorphous or the 2nd semi-conductor layer 87 of a microcrystal outside from inside at order rather than the amorphous pin junction layer 86 and this pin junction layer. This invention like drawing 18 moreover, the internal cel 101 In order, on the other hand, it has the 1st semi-conductor layer 104 of an electric conduction format, and amorphous and/or the semi-conductor layer 105,106 of a microcrystal of an another side electric conduction format outside from inside. The external cel 102 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 107 of an electric conduction format, the amorphous intrinsic-semiconductor layer 108, and the 2nd semi-conductor layer 111 of the microcrystal of an another side electric conduction format outside from inside. Moreover, this invention is drawing 19 . ** -- outside the internal cel 112 with the amorphous 1st semi-conductor layer 114 of an electric conduction format on the other hand in order from inside like It has the amorphous intrinsic-semiconductor layer

115 and the amorphous semiconductor layer 117 of an another side electric conduction format. The external cel 113 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 118 of an electric conduction format, the amorphous intrinsic-semiconductor layer 119, and the 2nd semi-conductor layer 122 of the microcrystal of an another side electric conduction format outside from inside. This invention like drawing 20 moreover, the internal cel 124 In order, from inside, outside The 1st semi-conductor layer 126 with an electric conduction format amorphous on the other hand, It has the intrinsic-semiconductor layer 127 of a microcrystal, and the amorphous semiconductor layer 129 with an optical band gap are an another side electric conduction format and larger than the 1st semi-conductor layer. The external cel 125 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 130 of an electric conduction format, the amorphous intrinsic-semiconductor layer 131, and the 2nd semi-conductor layer 134 of the microcrystal of an another side electric conduction format outside from inside. If this invention is followed, a microcrystal (muc) semi-conductor layer can have high conductivity, and can improve photoelectric conversion efficiency by introducing such a microcrystal semi-conductor layer between the 1st semi-conductor layer and a pin junction layer. While the heterojunction of the amorphous pin junction layer and 2nd semi-conductor layer can perform effective collection of an optical generation carrier, loss of recombination of an optical generation carrier is mitigable with an amorphous pin junction layer again. By receiving the reflected light by the inner surface of the crevice of a base material, temperature up is carried out to 40-80 degrees C, degradation of the photoelectric transfer characteristic is controlled by this, and the amorphous semiconductor is convenient. Since this optoelectric transducer is formed almost spherically, it will be controlled that the incidence energy of the light per [which receives direct light and the reflected light] unit area becomes large, and degradation of the photoelectric transfer characteristic will be controlled by this. Moreover, this invention is characterized by the 1st semi-conductor layer being a direct semiconductor layer. Moreover, this invention is characterized by a direct semiconductor layer being one kind chosen from the group who consists of InAs, GaSb, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe. If this invention is followed, the direct semiconductor layer which is easy to absorb light can realize the inside 1st semi-conductor layer, sufficient transition probability of an electron and an electron hole can be acquired by this, and photoelectric conversion efficiency can be improved also by this. Moreover, two or more base materials adjoin, this invention is arranged, and the periphery of each base material is extended and formed in the method of outside, and it is this periphery and is characterized by the thing for which the 1st conductor of a base material and the 2nd conductor of the base material of another side are connected electrically repeatedly while adjoining. Moreover, said each periphery starts, has a part or a falling part, and starts, and the part or falling part of this invention is characterized by connecting electrically repeatedly. If this invention is followed, by the periphery of two or more base materials with which the optoelectric transducer was carried, the 1st conductor of one base material and the 2nd conductor of the base material of another side can be connected in piles, and the high electrical potential difference which carries out the series connection of the photoelectromotive force by the optoelectric transducer for every base material, and wishes for it in this way can be taken out. As long as it follows this invention, it falls with the standup part of the periphery of a base material, and a part is connected electrically in piles, or you may make it connect standup parts or falling parts electrically, as shown in below-mentioned drawing 12 and below-mentioned drawing 13 . By this, the crevice of a base material can be approached and as many crevices and optoelectric transducers as possible can be arranged now in a limited area.

[Embodiment of the Invention] Drawing 1 is some expanded sectional views of the optical power plant 1 of one gestalt of operation of this invention, drawing 2 is the sectional view showing the configuration of the optical whole power plant 1, and drawing 3 is the decomposition perspective view of the optical power plant 1 shown in drawing 2 . The combination object 4 which consists of two or more optoelectric transducers 2 which have a fundamental almost spherical configuration, and the base material 3 with which that optoelectric transducer 2 is carried is laid underground in the packed bed 5 which consists of a translucency synthetic-resin ingredient, for example, PVB (polyvinyl butyral), EVA (ethylene vinyl acetate), etc., the translucency protection sheets 6, such as a polycarbonate, are arranged and the optical power plant 1 is fixed to this packed bed 5 at a light source side, such as sunlight. The protection sheet 6 of a packed bed 5 and the waterproof rear-face sheet 12 which changes from a synthetic-resin ingredient etc. to the front face of an opposite hand (lower part of drawing 1) are fixed. In this way, the configuration of the optical whole power plant 1 is tabular [flat]. An optoelectric transducer 2 has the 1st semi-conductor layer 7 and the 2nd semi-conductor layer 8 of the method of outside [it]. Opening 9 is formed in the 2nd semi-conductor layer 8. A part of 1st semi-conductor layer 7 10 is exposed under drawing 1 from opening 9. By irradiating light 11 from the upper part of drawing 1 , photoelectromotive force is outputted from between the 1st and 2nd semi-conductor layer 7 of an optoelectric transducer 2, and 8. An electric insulator 15 is sandwiched between the 1st conductor 13 and the 2nd conductor 14, in this way, the 1st and 2nd

conductors 13 and 14 are electrically insulated through an electric insulator 15, and a base material 3 is constituted. The 1st and 2nd conductors 13 and 14 may be aluminium foil, and may be other metal sheets. Electric insulators 15 may be synthetic-resin ingredients, such as polyimide, and may consist of other electric insulation ingredients. Two or more crevices 17 of each are formed adjacently, and the inner surface of this crevice 17 is formed with the 1st conductor 13. An optoelectric transducer 2 is arranged at the bottom in each crevice 17, respectively. Drawing 4 is some top views of a base material 3. the opening edge 18 of a crevice 17 -- a polygon -- it is -- for example, -- the gestalt of this operation -- a swage block -- it may be forward six square shapes of a **, and you may be other polygons of three or more square shapes with other gestalten of operation of this invention, for example. In drawing 4 , the die length W1 of the opening edge 18 may be 2mm. Each opening edge 18 which adjoins mutually stands in a row in succession by the inverted-L-shaped flection [in / in a crevice 17 / drawing 1] 19. As many crevices 17 as possible can be formed in the area which attends light 11 by this, therefore the reflected light by the 1st conductor 13 of the inner surface of a crevice 17 can be reflected and led to an optoelectric transducer 2, and a condensing ratio can be enlarged. A crevice 17 is formed in parabolic in the shape of a taper, for example as it becomes a bottom. The 1st semi-conductor layer 7 of an optoelectric transducer 2 is electrically connected [at the bottom of a crevice 17] to the 2nd conductor 14 of a base material 3 in a connection 21. The 2nd semi-conductor layer 8 of an optoelectric transducer 2 is the bottom of a crevice, or its circumference, and is electrically connected to the 1st conductor 13 of a base material 3. Drawing 5 is the sectional view showing the optoelectric transducer 31 in the condition before being carried in the base material 3 of an optoelectric transducer 2. The optoelectric transducer 31 of drawing 5 has cross-section structure similar to above-mentioned drawing 1 . The 1st semi-conductor layer 7 is spherical, and consists of the n form Si. The 1st semi-conductor layer 7 may be amorphous one, a single crystal, or polycrystal. The 2nd semi-conductor layer 8 formed in a way outside this 1st semi-conductor layer 7 is the p form Si. This 2nd semi-conductor layer 8 may be amorphous one, a single crystal, or polycrystal. If this 2nd semi-conductor layer 8 takes a large optical band gap rather than the 1st semi-conductor layer 7, p form a-SiC, then a wide gap aperture operation will be attained, for example. With other gestalten of operation of this invention, the 1st semi-conductor layer 7 shown in drawing 5 may be one kind chosen from the group who consists of InAs which is realized by the direct semiconductor layer, for example, has n form electric conduction format, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe. The 2nd semi-conductor layer 8 is formed on the 1st semi-conductor layer 7 formed of this direct semiconductor layer, and this 2nd semi-conductor layer 8 is one kind chosen from the group of a compound semiconductor similar to Semi-conductor AlGaAs and CuInSe2 which have p form electric conduction format, Cu(InGa) Se2, GaAs, AlGaP, CdTe, or it. In this way, pn junction structure is formed. Like below-mentioned drawing 6 , between the 1st semi-conductor layer 68 and the 2nd semi-conductor layer 70, i semi-conductor layer 69 is formed and pin junction structure may be formed of this at the process which uses an amorphous semiconductor for the 1st and 2nd semi-conductor layers 7 and 8. How to manufacture the combination object 4 with the base material 3 shown in drawing 1 is explained below using the optoelectric transducer 31 shown in drawing 5 . Drawing 6 is a sectional view for explaining how to manufacture the combination object 4 which has an optoelectric transducer 2 and a base material 3. After the spherical optoelectric transducer 2 shown in above-mentioned drawing 5 is manufactured, as shown in drawing 6 , cutting of the optoelectric transducer 2 is carried out. In the optoelectric transducer 2 shown in drawing 6 , a part of 1st semi-conductor layer 7 10 is exposed from the opening 9 of the 2nd semi-conductor layer 8. As for this opening 9, the central angle theta 1 is formed in a plane in less than 180 degrees. The central angle theta 1 may be 45-90 degrees, and may be 60-90 degrees preferably. The outer diameter D1 of an optoelectric transducer 31 may be for example, under 0.5-2mmphi, and is 0.8-1.2mmphi still more preferably. The bore of opening 9 is shown by the reference mark D2. Condensing ratio x=S1/S2 is two to 8 times, and is four to 6 times preferably. Drawing 7 is a sectional view for explaining the process which carries out cutting of the spherical optoelectric transducer 31, and forms opening 9. Vacuum attraction of the upper part is carried out with the attraction pad 34, respectively, and two or more spherical optoelectric transducers 31 are ground with the endless belt-like abrasives 35. Revolution actuation of the abrasives 35 is wrapped and carried out over rollers 36 and 37. It is drawing 6 again. It refers to, the 1st conductor 13 of aluminium foil is prepared in manufacture of a base material 3, and the connection hole 39 is formed in this 1st conductor 13. The bore D3 of the connection hole 39 is less than one outer diameter D of an optoelectric transducer 2, and is chosen as the value exceeding the bore D2 of the opening 9 of the 2nd semi-conductor layer 8 (D1>D3> D2). The sheet metal-like electric insulator 15 is prepared and the connection hole 40 is formed in this electric insulator 15. The bore D4 of the connection hole 40 is less than two bore D of the opening 9 of an optoelectric transducer 2 (D2> D4). In this way, the 1st conductor 13 which has the connection hole 39, and the electric insulator 15 which has the connection hole 40 pile up and paste up, and is unified, and each axis of these connection holes 39 and 40 exists on a straight line. Furthermore, the 2nd conductor 14 piles up and pastes up, and is unified, and flat base

material 3a is formed. With other gestalten of operation of this invention, the 1st conductor 13 which has the connection hole 39, the electric insulator 15 which has the connection hole 40, and the 2nd conductor 14 pile up simultaneously, paste up, and may be unified. The thickness of the 1st and 2nd conductors 13 and 14 and an electric insulator 15 may be 60 micrometers. Near [opening 9] an optoelectric transducer 2 fits into the connection hole 39, and the connection hole 40 of an electric insulator 15 is faced it. The connection hole 39 is faced said opening 9 neighborhood, and it may be placed on the 1st conductor 13. Drawing 1 is also referred to collectively and the part which surrounds the 1st connection hole 39 the peripheral face which surrounds the opening 9 of the 2nd semi-conductor layer 8 rather than the opening 9 of an optoelectric transducer 2 in the upper part of drawing 1 , the inner skin of the part 39 of 1st connection hole 39 near [the 1st conductor 13 of base materials 3a or 3], i.e., the 1st connection hole, or near [1st connection hole 39] the is connected electrically. The amount of [of the peripheral face of the 2nd semi-conductor layer 8 and the 1st conductor 13 / 44 (refer to drawing 1)] connection It is located in an opposite hand (upper part of drawing 1) in the 1st conductor 13 rather than the periphery section 45 of the virtual flat surface containing opening 9. It prevents certainly the 1st conductor 13 flowing electrically with the 1st conductor 7 by this, and exists in an opening 9 side (lower part of drawing 1) rather than the virtual flat surface 47 which is parallel to the virtual flat surface containing opening 9 as for a part for this connection 44, and passes along the core 46 of an optoelectric transducer 2. Then, plastic deformation processing of the flat base material 3a is carried out with a press, and two or more crevices 17 adjoin and are formed. The 2nd conductor 14 deforms so that a projection 40, i.e., a connection hole, may be inserted in above drawing 6 and it may upheave from the connection hole 40 of an electric insulator 15, and a connection 21 is formed. In this way, the height H1 of the formed base material 3 may be about 1mm. Any may be first performed on a target one by one, or the electrical installation process of the 1st semi-conductor layer 7 and the 2nd conductor 14 and both the processes with the electrical installation process of the 2nd semi-conductor layer 8 and the 1st conductor 13 may be performed simultaneously again. In this way, the optoelectric transducer 2 which has opening 9 in the formed crevice 17 is arranged. With other gestalten of operation of this invention, after carrying out plastic deformation processing of the three-tiered structure of the 13/insulator 15 of conductors/a conductor 14 so that a crevice 17 may be formed, each above-mentioned openings 39 and 40 may be formed in a conductor 13 and an insulator 15 using two kinds of each laser beam, respectively, and a base material 3 may be manufactured. Drawing 8 is the simplified perspective view showing the process which arranges an optoelectric transducer 2 in the crevice 17 of a base material 3. The optoelectric transducer 2 by which cutting was carried out where vacuum attraction is carried out with the attraction pad 34 in above-mentioned drawing 7 is conveyed and arranged in the crevice 17 of a base material 3 with the position which the opening 9 faced caudad. Two or more, 100 pieces and a train are accomplished and the attraction pad 34 is formed. After the optoelectric transducer 2 has been arranged in a crevice 17 with the attraction pad 34, only one pitch of a crevice 17 is moved to a travelling direction 42, and a base material 3 arranges an optoelectric transducer 2 to the new crevice 17 using the attraction pad 34 like the above-mentioned. Such actuation is repeated and an optoelectric transducer 2 is arranged in all the crevices 17. Then, an optoelectric transducer 2 is electrically connected to a base material 3 at the bottom of a crevice 17. It exposes by opening 32 and the 1st semi-conductor layer 7 of an optoelectric transducer 2 is electrically connected to a connection 21 with the connection hole 40 of the 2nd conductor 14. Moreover, as for the 2nd semi-conductor layer 8 of an optoelectric transducer 2, the periphery section of the upper part of opening 9 is connected to the part and the electric target of the connection hole 39 neighborhood of the 1st conductor 13. Each electric connection with these 1st and 2nd conductors 13 and 14 and 2nd and 1st semi-conductor layers 8 and 7 of an optoelectric transducer 2 may be electrically connected using a metal bump using a laser beam, using an eutectic or a conductive paste. In this way, without using the solder containing lead, electrical installation can be performed and it is desirable from a viewpoint of environmental protection. Drawing 9 is the perspective view showing the condition that the combination objects 4 and 4b which have an optoelectric transducer 2 and a base material 3 were connected. Electric connection is made by the plane peripheries 61 and 61b prolonged in a way outside the combination objects 4 and 4b. Drawing 10 is the periphery 61 of the combination objects 4 and 4b shown in drawing 9 , and a decomposition sectional view near 61b. On the 1st conductor 13 of the base material 3 of one combination object 4, it connects electrically repeatedly and the 2nd conductor 14 of base material 3b of another side is fixed. In this way, the high electrical potential difference which carries out the series connection of the photoelectromotive force by two or more base materials 3 and the optoelectric transducer 2 of every 3b, therefore he wishes can be taken out. Drawing 11 is the simplified side elevation showing the condition of having connected electrically the combination objects 4, 4b, and 4c. While adjoins and periphery 61of combination object 4b of another side b is electrically connected on the periphery 61 of the combination object 4, or to the bottom as mentioned above in piles. Furthermore, the above-mentioned periphery 61b of combination object 4b and the

periphery 61b1 of an opposite hand are put on periphery 61of adjoining combination object 4c c up and down, and are electrically connected to it. With the configuration arranged as one periphery 61b of combination object 4b is shown in drawing 11 under the periphery 61b of the combination object 4, the periphery 61b1 of another side is arranged in the upper part of periphery 61c of combination object 4c, so to speak, is together put up and down by turns in the shape of two step in this way, and is connected. The die length L61 with which the longitudinal direction in a periphery 61, 61b;61b1, and drawing 11 of 61c lapped may be 1mm. drawing 12 It is the sectional view showing the electric connection structure of the combination objects 4 and 4b which ** and adjoin. The periphery 61 of one combination object 4 has started, and periphery 61of combination object 4b of another side b falls, and is formed. The conductor 14 in a periphery 61 and the conductor 13 of periphery 61b are connected electrically. Drawing 13 is the sectional view showing the electrical installation condition of the combination objects 4 and 4b in other gestalten of operation of this invention. Although the gestalt of this operation is similar to the gestalt of operation of drawing 12 , with the gestalt of this operation, the conductor 13 of a periphery 61 with which the combination object 4 started is especially connected to the conductor 14 of periphery 61b with which combination object 4b fell electrically. According to such drawing 12 and the connection structure of drawing 13 , the crevice of base materials 3 and 3b can be approached, and as many crevices and optoelectric transducers as possible can be arranged now in a limited area. Drawing 14 is some sectional views of the optoelectric transducer 2 of other gestalten of operation of this invention. each semi-conductor layer is shown by the flat configuration developed to the hoop direction at drawing 14 and below-mentioned drawing 15 - drawing 20 -- also although kicked, actually, a laminating is carried out to the shape of radii one by one toward the upper part at a target from the lower part from the method of the inside of radial to the method of outside, i.e., each drawing, and it has the spherical surface and is formed. In drawing 14 , it has the configuration which has the n form microcrystal (muc) Si layer 63 and the double heterojunction layer of the n form polycrystal (poly) Si layer 64/p form a-SiC layer 65/p form microcrystal SiC layer 66 on a target one by one toward the method of outside from the method of the inside of radial of an optoelectric transducer. The configuration of the optoelectric transducer which has such pn junction is shown in a table 1.

[A table 1]

図	参照符	層
14	66	p μc−SiC
	65	p a−SiC
	64	n poly Si
	63	n μc−Si
15	70	p a−SiC
	69	i a−SiC
	68	n μc−Si
16	77	p μc−SiC
	76	p a−SiC
	75	i a−SiC
	74	i a−Si
	73	n μc Si

Drawing 15 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. Each semi-conductor layers 68, 69, and 70 have the configuration of the above-mentioned table 1. With other gestalten of operation of this invention, Si of the single crystal of n form or polycrystal may be used as a semi-conductor layer 68 in the optoelectric transducer 2 of drawing 15 . Drawing 16 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. The concrete configuration of each semi-conductor layer is as being shown in the above-mentioned table 1. With other gestalten of operation of this invention, the semi-conductor layers 73 and 74 in this drawing 16 may be n form crystals Si. Moreover, the semi-conductor layer 74 may be i form microcrystal Si. Drawing 17 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. The optoelectric transducer 2 of drawing 17 - drawing 20 has the stack structure of 2 junction. With other gestalten of operation of this invention, the optoelectric transducer 2 which has the stack structure of 3 or more ****s may be used. The concrete configuration of each optoelectric transducer 2 of drawing 17 - drawing 20 is as being shown in a table 2.

[A table 2]

図		参照符	層
17	外部セル 82	87	a−SiC
		86	a−Si pin
	内部セル 81	85	p a−Si
		84	n poly−Si
18	外部セル 102	111	p μc−SiC
		110	p a−SiC
		109	i a−SiC
		108	i a−Si
		107	n μc−Si
	内部セル 101	106	p μc−SiC
		105	p a−SiC
		104	n poly−Si
		103	n μc−SiC
19	外部セル 113	122	p μc−SiC
		121	p a−SiC
		120	i a−SiC
		119	i a−Si
		118	n μc−Si
	内部セル 112	117	p a−SiC
		116	i a−SiC
		115	i a−Si
		114	n a−SiC
20	外部セル 125	134	p μc−SiC
		133	p a−SiC
		132	i a−SiC
		131	i a−Si
		130	n μc−Si
	内部セル 124	129	p a−SiC
		128	i a−Si
		127	i μc−Si
		126	n a−Si

In drawing 17 , the external cel 82 is formed in a way outside the internal cel 81. The semi-conductor layer 84 may be n form amorphous silicon, the semi-conductor layer 85 may be p form microcrystal Si, and the semi-conductor layer 87 may be Microcrystal SiC further. At a target the pin junction layer of the semi-conductor layer 86 from the method of the inside of radial of an optoelectric transducer 2 one by one to the method of outside p form, Although the laminating of each semi-conductor layer of i form and n form may be carried out and it may be constituted, with other gestalten of operation of this invention The electric conduction format of the semi-conductor layers 84 and 85 of the internal cel 81 is made into reverse with drawing 17 , and the electric conduction format of the semi-conductor layers 86 and 87 of the external cel 82 is made into reverse with drawing 17 . In this semi-conductor layer 86 The semi-conductor layer of n form, i form, and p form may be formed in a target one by one, it is as above-mentioned and this has it about the optoelectric transducer 2 equipped with the pin junction layer which has other configurations. [same] Drawing 18 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. To the internal cel 101 and the external cel 102, the laminating of semi-conductor layer 103-106;107-111 is carried out, and they are constituted. Drawing 19 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. To the internal cel 112 and the external cel 113, the laminating of semi-conductor layer 114-117;118-122 is carried out, and they are constituted. It may replace with the semi-conductor layer 117, and you may be p form amorphous silicon O. The semi-conductor layer 121 may be p form amorphous silicon O similarly. Drawing 20 is the sectional view of the optoelectric transducer 2 of the gestalt of the operation of further others of this invention. As for the internal cel 124 and the external cel 125, semi-conductor layer 126-129;130-134 are formed. It replaces with the semi-conductor layer 129, and p form amorphous silicon O may be used. The optoelectric transducer 2 of this invention may have configurations other than the above-mentioned configuration. With other

gestalten of operation of this invention, it replaces with a base material 3, for example, conductive ingredients, such as nickel, may be plated on the front face, the 1st and 2nd conductors may be formed [a crevice may be formed with shaping of injection molding, such as electric insulation synthetic-resin ingredients, such as a polycarbonate, etc.,] in it, and a base material may be manufactured. Although the 1st and 2nd conductors may be aluminium foil, they may be formed of Cr plating or Ag plating, and may form these metals nickel, Cr, aluminum, and Ag etc. by vacuum evaporationo or the spatter further. An enveloping layer may be formed on the 1st conductor, and this enveloping layer may be metal formed of plating etc., or may be a product made of synthetic resin.

[Translation done.]

DESCRIPTION OF DRAWINGS

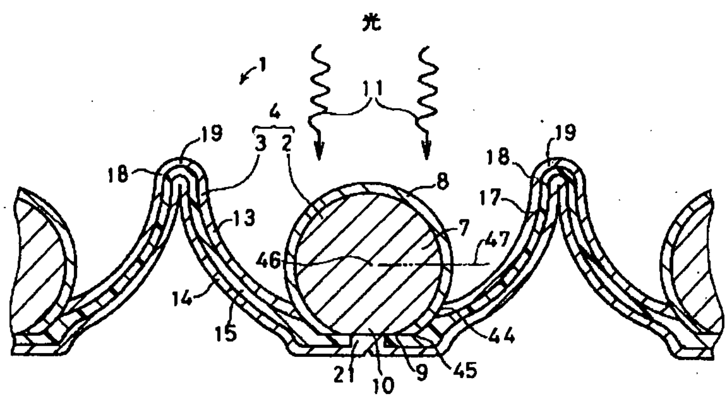
[Brief Description of the Drawings]
[Drawing 1] They are some expanded sectional views of the optical power plant 1 of one gestalt of operation of this invention.
[Drawing 2] It is the sectional view showing the configuration of the optical whole power plant 1.
[Drawing 3] It is the decomposition perspective view of the optical power plant 1 shown in drawing 2 .
[Drawing 4] They are some top views of a base material 3.
[Drawing 5] It is the sectional view showing the optoelectric transducer 31 in the condition before being carried in the base material 3 of an optoelectric transducer 2.
[Drawing 6] It is a sectional view for explaining how to manufacture the combination object 4 which has an optoelectric transducer 2 and a base material 3.
[Drawing 7] It is a sectional view for explaining the process which carries out cutting of the real ball-like optoelectric transducer 31, and forms opening 32.
[Drawing 8] It is the simplified perspective view showing the process which arranges an optoelectric transducer 2 in the crevice 17 of a base material 3.
[Drawing 9] It is the perspective view showing the condition that the combination objects 4 and 4b which have an optoelectric transducer 2 and a base material 3 were connected.
[Drawing 10] They are the periphery 61 of the combination objects 4 and 4b shown in drawing 9 , and a decomposition sectional view near 61b.
[Drawing 11] It is the simplified side elevation showing the condition of having connected electrically the combination objects 4, 4b, and 4c.
[Drawing 12] It is the sectional view showing the electric connection structure of the adjoining combination objects 4 and 4b.
[Drawing 13] It is the sectional view showing the electrical installation condition of the combination objects 4 and 4b in other gestalten of operation of this invention.
[Drawing 14] They are some sectional views of the optoelectric transducer 2 of other gestalten of operation of this invention.
[Drawing 15] It is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention.
[Drawing 16] It is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention.
[Drawing 17] It is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention.
[Drawing 18] It is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention.
[Drawing 19] It is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention.
[Drawing 20] It is the sectional view of the optoelectric transducer 2 of the gestalt of the operation of further others of this invention.
[Description of Notations]
1 Optical Power Plant
2 Optoelectric Transducer
3 3b Base material
4 Combination Object
7 1st Semi-conductor Layer

8 2nd Semi-conductor Layer
9 Opening
10 Part
13 1st Conductor
14 2nd Conductor
15 Electric Insulator
17 Crevice
18 Opening Edge

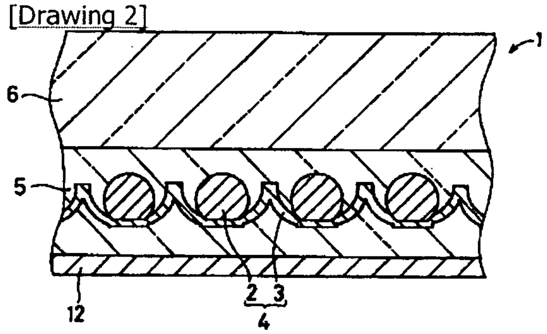
[Translation done.]

DRAWINGS

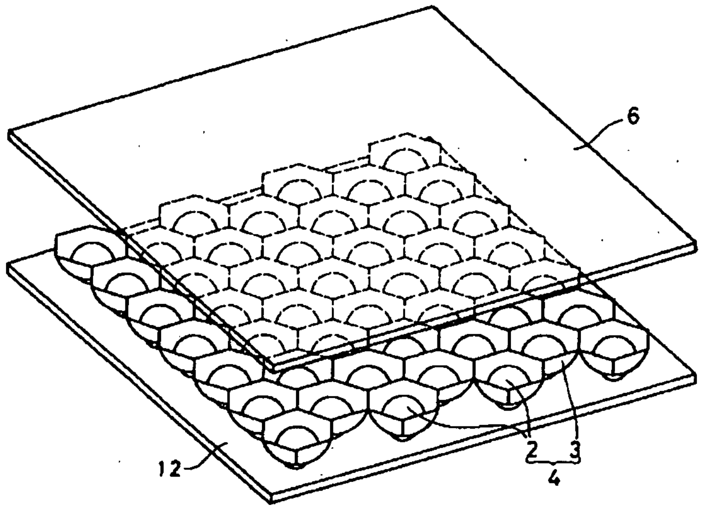
[Drawing 1]



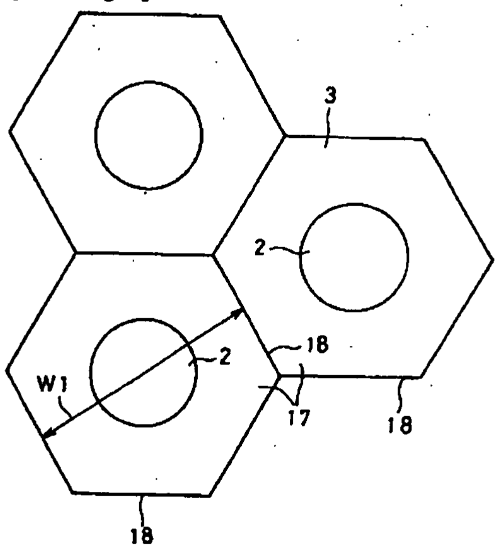
[Drawing 2]



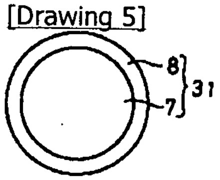
[Drawing 3]



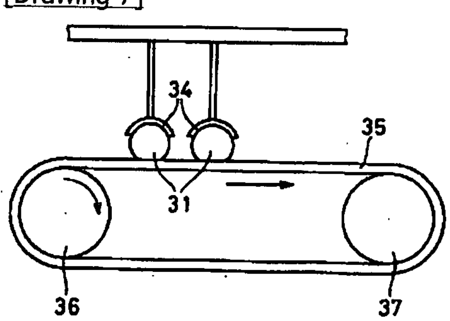
[Drawing 4]



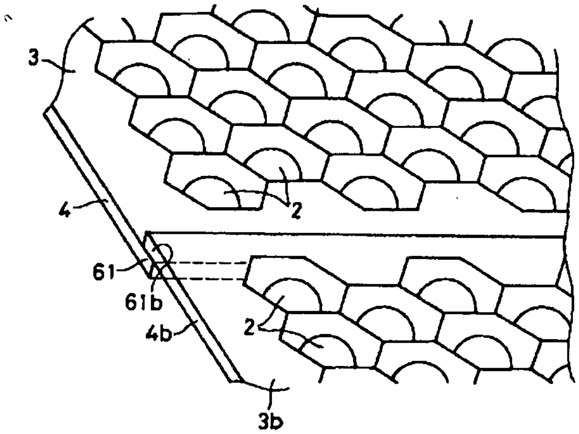
[Drawing 5]



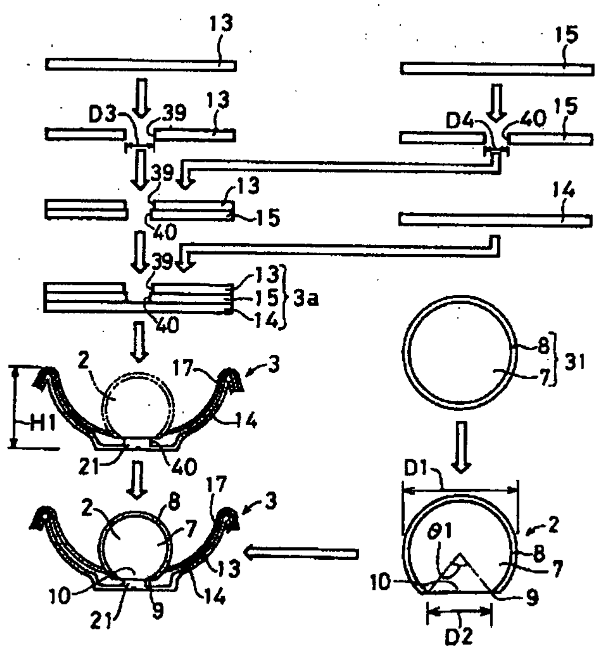
[Drawing 7]



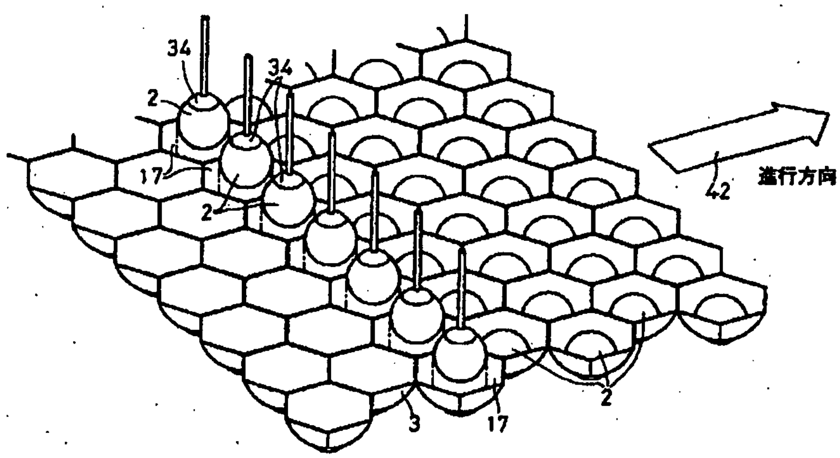
[Drawing 9]



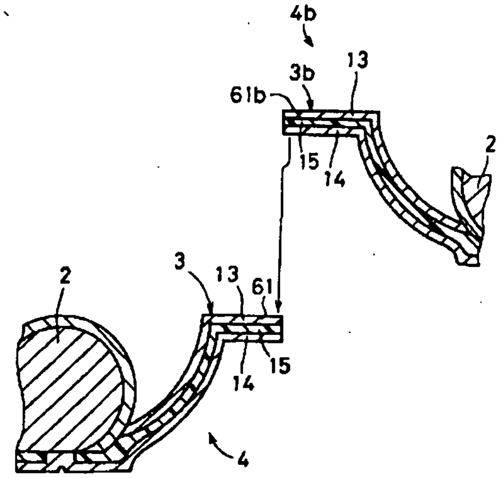
[Drawing 6]



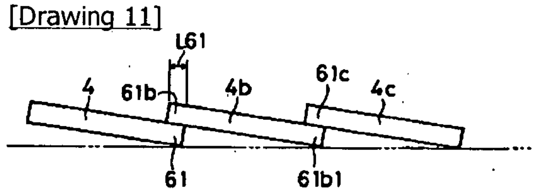
[Drawing 8]



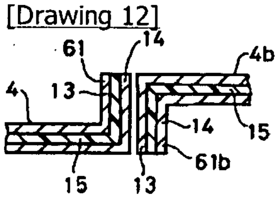
[Drawing 10]



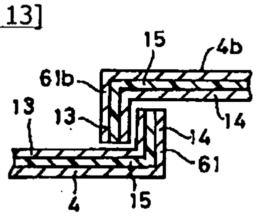
[Drawing 11]



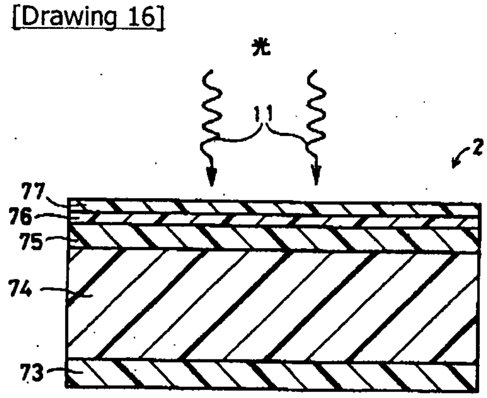
[Drawing 12]



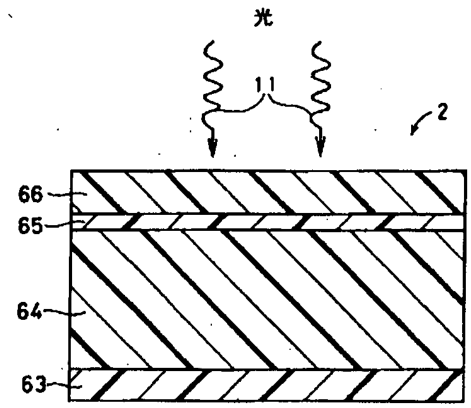
[Drawing 13]



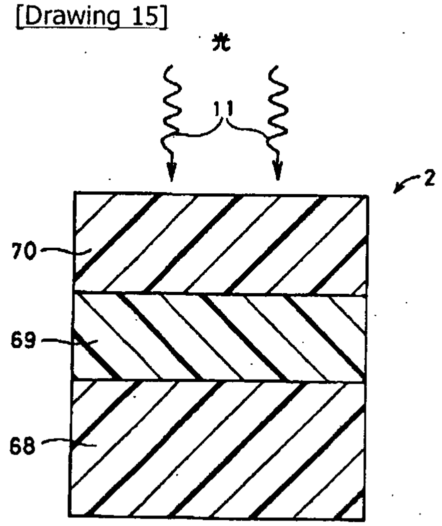
[Drawing 16]



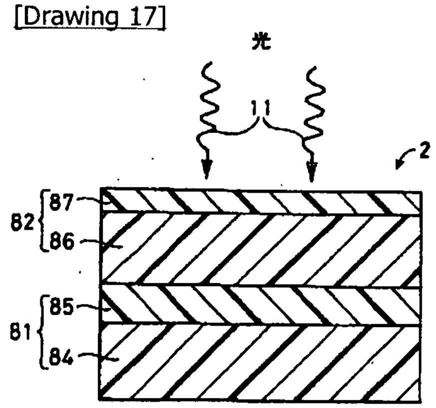
[Drawing 14]



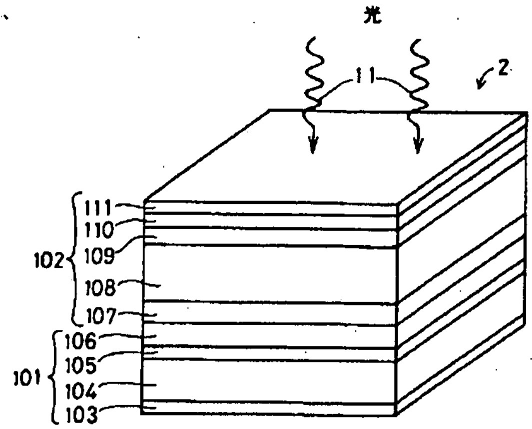
[Drawing 15]



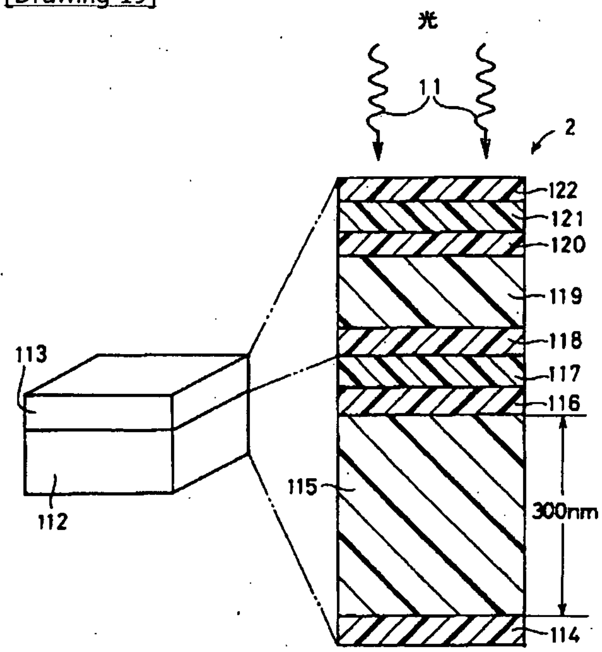
[Drawing 17]



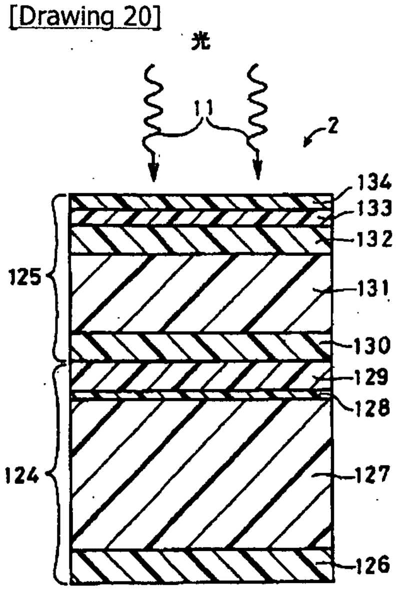
[Drawing 18]



[Drawing 19]



[Drawing 20]



[Translation done.]

WRITTEN AMENDMENT

[Procedure amendment]
[Filing Date] November 27, Heisei 12 (2000. 11.27)
[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] DETAILED DESCRIPTION
[Method of Amendment] Modification
[Proposed Amendment]
[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an optical power plant. A pin junction must be interpreted as a thing including the configuration by which each semi-conductor layer of n form, i form, and p form was formed one by one in outside [from] or inside from outside at the target among almost spherical optoelectric transducers among this description.
[0002]
[Description of the Prior Art] The 1st typical advanced technology contains the optoelectric transducer which consists of a crystal silicon semi-conductor wafer. In this 1st advanced technology, the process for manufacturing a crystal is complicated and costs become high. Moreover, since a semi-conductor wafer is manufactured through processes, such as cutting, slicing, and polishing, from single crystal bulk, a process is complicated, and the cut waste of the crystal further produced at processes, such as the cutting, slicing, and polishing, makes it a capacity factor, becomes about 50% or more, and becomes useless.
[0003] Other 2nd advanced technology which solves this problem consists of an amorphous silicon (abbreviated-name a-Si) thin film. Since this 2nd advanced technology forms a photo-electric-translation layer by the shape of a thin film by plasma chemistry vapor growth, its processes, such as cutting from the single crystal bulk of the conventional technique, slicing, and polishing, are unnecessary, and it has the advantage that all the deposited film can be used as a barrier layer of a component. On the other hand, it originates in amorphous structure, and many crystal defects, i.e., gap States, exist in the interior of a semi-conductor, therefore an optical induction degradation phenomenon exists, and an amorphous silicon solar battery has the problem that photoelectric conversion efficiency falls. In order to solve this problem, in the former, the technique inactivated by the hydrogen treating is developed and manufacture of electron devices, such as an amorphous silicon solar battery, is attained.
[0004] However, also by such processing, it is impossible to abolish the effectiveness of a crystal defect, for example, the weak point that photoelectric conversion efficiency deteriorates about 15 to 25% is still held in the amorphous silicon solar battery.
[0005] The stack form solar battery which makes i layers of photoelectrical activity extremely thin, and makes a photovoltaic cell 2 junction or 3 junction as a new technique which controls the photodegradation in which it succeeded recently was realized, and it has succeeded in controlling photodegradation to about 10%. Although the module technique of it becoming clear photodegradation being recovered, and operating/working in such the condition is also being developed when this photodegradation has a high operating temperature of a photovoltaic cell, it is hard to say that it is enough.
[0006] Other 3rd advanced technology is indicated by the pan which solves such a problem at JP,7-54855,B. The n form Si epidermis section is etched into the flat aluminium foil with which the hole opened the spherical particle which has the n form Si epidermis section in a p form Si ball from the rear face of a pad and its aluminium foil, an internal p form Si ball is exposed, this exposed p form Si ball is connected to another aluminium foil, and a solar array consists of this 3rd advanced technology.

[0007] It is necessary to mitigate the amount of Si used of a high grade, to make small a drawing wax, then the outer diameter of a particle for reduction of the cost price, and to make the whole average thickness thin in this 3rd advanced technology. Moreover, the particle of a large number which need to enlarge a light-receiving side in order to aim at improvement in conversion efficiency, approach mutually, arrange a particle in order to enlarge the light-receiving side, therefore have a small outer diameter must be arranged densely, and must be connected to aluminium foil. Consequently, the connection routing of a particle and aluminium foil becomes complicated, and it is inferior to reduction of the cost price.

[0008]

[Problem(s) to be Solved by the Invention] It reduces the amount of the semiconductor materials used, such as Si of a high grade, and moreover the object of this invention is easy to mass-produce, that is, is offering the high-reliability which enables manufacture of saving resources and an energy-saving form, and is realized cheaply, and an efficient optical power plant.

[0009]

[Means for Solving the Problem] Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It is the optical power plant characterized by connecting with the 2nd semi-conductor layer of an optoelectric transducer electrically, and the 2nd conductor containing the base material electrically connected to said exposed part of the 1st semi-conductor layer.

[0010] If this invention is followed, two or more almost spherical optoelectric transducers of each will be arranged in two or more crevices of each of a base material, respectively. The inner surface of this crevice It is formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor, therefore it is reflected by the 1st conductor or the enveloping layer formed upwards the 1st conductor of a crevice inner surface, and the light from the outside, such as sunlight, is irradiated by the optoelectric transducer while it is directly irradiated by the optoelectric transducer.

[0011] Since an optoelectric transducer is arranged in a crevice, spacing is opened mutually, and it is prepared in it, namely, an optoelectric transducer is not arranged densely. Therefore, while being able to reduce the amount of the ingredients used, such as the high grade which decreases the number of an optoelectric transducer and constitutes an optoelectric transducer, for example, Si etc., the connection process of an optoelectric transducer and the conductor of a base material can be made easy.

[0012] And two or more crevices are adjoined and formed mutually, by this, it reflects by the crevice inner surface, the light from the outside irradiates an optoelectric transducer, and the light from the outside can be effectively used for it for generating of the photoelectromotive force of an optoelectric transducer. In this way, generated output per [which faces the light source of the optoelectric transducer of this invention] unit area can be enlarged as much as possible.

[0013] You may change from a single crystal, polycrystal, or an amorphous ingredient to the optoelectric transducer of this invention, and may change from the ingredient of a silicon system, a compound semiconductor system, and others to it, may have each structure of pn form and a pin form, in addition may have the configuration of for example, a shot key barrier form, an MIS (metal-insulator-semiconductor) form, a gay junction type, a heterojunction form, and others.

[0014] It has exposed selectively from opening of the outside 2nd semi-conductor layer, and the 1st semi-conductor layer by the side of a core can take out the photoelectromotive force generated at the time of an optical exposure from between these 1st and 2nd semi-conductor layers. The 2nd semi-conductor layer of the optoelectric transducer arranged in the crevice of a base material is electrically connected to the 1st conductor of a base material. The exposed part of the 1st semi-conductor layer inside an optoelectric transducer is electrically connected with the 1st conductor at the 2nd conductor prepared through the electric insulator. With the structure where the 1st conductor and the 2nd conductor are formed in the shape of a field, with these 1st and 2nd conductors, parallel connection of two or more optoelectric transducers is carried out, and they can derive a big current.

[0015] Although an optoelectric transducer may be a real ball, even if it is not a real ball, if the outside surface is

[other than a real ball] almost spherical, it is good. The 1st semi-conductor layer may have the configuration near [whose] the core of the again almost spherical 1st semi-conductor layer you may be the configuration that the 1st semi-conductor layer was covered and formed in the peripheral face of the axis prepared beforehand, or is a cavity with other gestalten of operation of this invention, although a solid may be formed almost spherically.
[0016] Moreover, this invention is characterized by the outer diameter of an optoelectric transducer being 0.5-2mmphi.
[0017] As long as it follows this invention, the outer diameter of an optoelectric transducer may be 0.5-2mmphi, and may be 0.8-1.2mmphi preferably, or may be about 1mmphi again. While lessening enough the amount of the ingredients used, such as Si of a high grade, and being able to enlarge generating power now as much as possible moreover by this, handling of the spherical optoelectric transducer at the time of manufacture is easy, and productivity is excellent.
[0018] Moreover, this invention is characterized by the central angle theta 1 of opening of said 2nd semi-conductor layer being 45-90 degrees.
[0019] If this invention is followed, by choosing the central angle theta 1 as 60-90 degrees still more preferably by choosing it as 45-90 degrees as mentioned above, the 1st and 2nd semi-conductor layer can reduce the amount discarded by formation of said opening, and can control futility. And the area of opening required for the electrical installation of the 1st semi-conductor layer and the 2nd conductor of a base material can be obtained by choosing the central angle theta 1 as the range of such a value.
[0020] Moreover, the opening edge of the crevice where this invention was formed in the base material For example, each opening edge which is the polygon of the shape of a blow hole of a bee, and adjoins mutually Continuously, a crevice is formed in the shape of a taper as it becomes a bottom, it is the bottom of a crevice, or its circumference, and is characterized by connecting with the 2nd and 1st conductors with which the 1st and 2nd semi-conductor layer of an optoelectric transducer is insulated electrically mutually electrically, respectively.
[0021] This invention is the bottom of the crevice of a base material, or its circumference. Moreover, to the 1st conductor While the circular 1st connection hole 39 is formed, to an electric insulator The circular 2nd connection hole 40 which has an axis is formed on the straight line containing the axis of the 1st connection hole 39. Near [said] opening of an optoelectric transducer It fits into the 1st connection hole 39. The peripheral face of the upper part of opening of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part near an end face It is characterized by connecting electrically and connecting electrically to the 2nd conductor said part of the 1st semi-conductor layer exposed from said opening through the 2nd connection hole 40.
[0022] When this invention sets the outer diameter of an optoelectric transducer to D1, the bore of opening of said 2nd semi-conductor layer is set to D2, the bore of the 1st connection hole 39 is set to D3 and the bore of the 2nd connection hole 40 is set to D4 again,
$D1>D3>D2>D4$
It is characterized by it being alike and choosing.
[0023] If this invention is followed, said a part of 1st semi-conductor layer which near [said] opening of an optoelectric transducer fitted into the 1st connection hole 39 of the 1st conductor, and was exposed to it from the opening will be electrically connected to the 2nd conductor through the 2nd connection hole 40 formed in the electric insulator of a base material. The 1st and 2nd conductors of the base material which has the 1st conductor, an electric insulator, and the 2nd conductor by this can be easily connected now to the 2nd and 1st semi-conductor layer and the electric target of an optoelectric transducer, respectively.
[0024] The part which surrounds the 1st connection hole 39 rather than the opening 9 of below-mentioned drawing 1 in the upper part the inner skin of the peripheral face of the upper part of the opening 9 of the 2nd semi-conductor layer, the end face of the 1st connection hole 39 of the 1st conductor, or the part 39 near an end face, i.e., the 1st connection hole, and/or near [1st connection hole 39] the is electrically connected about the electrical installation of the 2nd semi-conductor layer and the 1st conductor.
[0025] the conductive paste which upheaved, plastic deformation could be carried out, and could be connected [the 2nd conductor 14 could insert the 2nd connection hole 40 in the part 10 exposed from the opening 9 of the 1st semi-conductor layer 7, for example,] electrically, or was prepared in the 2nd connection hole 40 -- or conductive bumps, such as a metal, etc. may connect with the 2nd conductor 14 electrically.
[0026] Moreover, by choosing these outer diameter D1 and bores D2, D3, and D4 as the above-mentioned inequality, an electric short circuit [**** / un-] is prevented and positive electrical installation becomes possible.
[0027] Moreover, this invention is characterized by choosing condensing ratio x=S1/S2 as 2-8, when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2.

[0028] Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. moreover, this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer It is 0.5-2mmphi, and when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2, it is the optical power plant characterized by choosing condensing ratio x=S1/S2 as 2-8.

[0029] Have an almost spherical configuration and it has the 1st semi-conductor layer and the 2nd semi-conductor layer of the method of outside [it]. moreover, this invention -- (a) -- two or more optoelectric transducers which a part of 1st semi-conductor layer is exposed from opening of the 2nd semi-conductor layer, and output photoelectromotive force from between the 1st and 2nd semi-conductor layers, and (b) -- a base material -- it is -- between the 1st conductor and the 2nd conductor -- Two or more crevices in which the condition of having insulated electrically was constituted through the electric insulator, and the inner surface was formed of the 1st conductor or the enveloping layer formed upwards the 1st conductor It adjoins, and it is formed, an optoelectric transducer is arranged in each crevice, and the reflected light by the 1st conductor or said enveloping layer formed upwards the 1st conductor of a crevice is irradiated by the optoelectric transducer. The 1st conductor It connects with the 2nd semi-conductor layer of an optoelectric transducer electrically. The 2nd conductor The base material electrically connected to said exposed part of the 1st semi-conductor layer is included. The outer diameter of an optoelectric transducer It is 0.8-1.2mmphi, and when setting area of the opening edge of the crevice of a base material to S1 and setting the cross section including the core of an optoelectric transducer to S2, it is the optical power plant characterized by choosing condensing ratio x=S1/S2 as 4-6.

[0030] if this invention is followed -- the opening edge of the crevice of a base material -- for example, a swage block -- it may be the polygon of a **, for example, you may be a hexagon, and this crevice is formed in the shape of a taper as it becomes a bottom, and an optoelectric transducer arranges it at that bottom -- having -- that optoelectric transducer -- the bottom of a crevice, or its circumference -- it is -- a base material -- each -- it connects with a conductor. The opening edge of a crevice is a polygon, and when each opening edge continues, all the carrier beam light can be irradiated at an optoelectric transducer the whole surface other than the location of the optoelectric transducer in the base material which faces the light sources, such as sunlight. Therefore, so to speak, a condensing form optoelectric transducer is [condensing ratio x=S1/S2] preferably realizable as two to 8 times as four to 6 times. Mutual spacing of an optoelectric transducer can be enlarged as mentioned above by this, and the number of an optoelectric transducer can be decreased, and an electric connection routing with a base material can be simplified. Therefore, the amount of the high grade semi-conductor used used as the ingredient of an optoelectric transducer can be decreased, and this invention can be cheaply carried out now. It is comparatively easy, and the configuration of a base material is excellent in productivity, and easy to manufacture.

[0031] for example, according to the experiment of this artificer, with this light power plant formed so that the outer diameter might be set to 800-1000 micrometerphi, the optoelectric transducer which consists of almost spherical Si Si of the same weight as Si which constitutes all the optoelectric transducers used with four to 6 times, then an optical power plant in the condensing ratio x The thickness when converting into the plate which has an area equal to the projected area to a virtual flat surface vertical to a beam of light from the light source to an optical power plant on imagination It is set to about 90-120 micrometers, therefore the epoch-making result that the amount of Si used of per generating power 1W can be managed with the value of less than 2g can be obtained. In the 1st advanced technology of the optoelectric transducer which consists of the above-mentioned crystal silicon semi-conductor wafer, the thickness of crystal silicon is 350-500 micrometers, and if a slice loss is included, it will be set to about 1mm. Therefore, in the 1st advanced technology, the amount of Si used of per generating power 1W is about abbreviation 15-20g. Therefore, in this invention, the amount of Si used is substantially mitigable compared with the 1st above-mentioned advanced technology.

[0032] The condensing ratio x can decrease the value exceeding 8, then the number which needs an optoelectric transducer, and can mitigate further the amount of Si used of per generating power 1W, but on the other hand actually, with the increment in the condensing ratio x, the condensing effectiveness which is a ratio to the light energy absorbed by the optoelectric transducer of the light energy by which incidence was carried out to the crevice will worsen, consequently performance degradation will be caused.
[0033] If this invention is furthermore followed, while choosing the outer diameter of an optoelectric transducer as 0.5-2mmphi and choosing it as 0.8-1.2mmphi preferably as above-mentioned While being able to decrease the number of optoelectric transducers and being able to mitigate the amount of Si used of per generating power 1W by choosing the condensing ratio x as 2-8, and choosing it as 4-6 prefe.ably, the electric connection routing of an optoelectric transducer and a base material can be simplified further. Thus, the combination with numerical selection of the outer diameter of an optoelectric transducer is important in order to decrease the number of optoelectric transducers and to reduce the amount of Si used of per generating power 1W.
[0034] With the configuration with which the number which needs an optoelectric transducer increases, and the outer diameter exceeds 2mmphi although the outer diameter of an optoelectric transducer reduces the amount of Si used under by 0.5mmphi, although the number which needs an optoelectric transducer decreases, the amount of Si used will increase.
[0035] If the condensing ratio x cannot reduce the amount of Si used enough and exceeds 8 less than by two, condensing effectiveness will get worse to less than 80%, and it will result in causing performance degradation. In this invention, by choosing the condensing ratio x as the range of the above-mentioned value, condensing effectiveness can be made into 80% or more, and it can be 90 more% or more now.
[0036] In this way, if this invention is followed, the outer diameter and the condensing ratio x of an optoelectric transducer will be chosen as the above-mentioned range of number, and the effectiveness which stood high that each of numbers which need an optoelectric transducer, and amount of Si used of per generating power 1W can be sharply decreased to 1 / 5 - 1/10 compared with the 3rd above-mentioned advanced technology by this will be attained.
[0037] Moreover, with the configuration which condensed by the above-mentioned condensing ratio using the amorphous silicon optoelectric transducer according to this invention, the temperature of an optoelectric transducer is raised compared with the optoelectric transducer of amorphous silicon sheet metal, for example, can be made into 40-80 degrees C. It is possible to control degradation of an amorphous silicon optoelectric transducer and to make it long lasting by this.
[0038] Moreover, an optoelectric transducer is characterized by forming in a way the 2nd semi-conductor layer 65 of the another side electric conduction format that an optical band gap is larger than the 1st semi-conductor layer, outside the 1st semi-conductor layer 64 of an electric conduction format, and on the other hand, having pn junction like drawing 14 in this invention.
[0039] Moreover, on the other hand, an optoelectric transducer is characterized by forming the amorphous intrinsic-semiconductor layers 69 and 74 and the amorphous 2nd semi-conductor layers 70 and 76 of an another side electric conduction format with an optical band gap larger than the 1st semi-conductor layer in this sequence at a way, and having a pin junction outside the 1st semi-conductor layers 68 and 73 of an electric conduction format like drawing 15 and drawing 16 in this invention.
[0040] Moreover, the 1st semi-conductor layer of this invention is the n form Si, and the 2nd semi-conductor layer is characterized by being p form amorphous silicon C.
[0041] Moreover, it is characterized by the n form Si where this invention is the 1st semi-conductor layer being n form crystal Si or n form microcrystal (muc) Si.
[0042] If this invention is followed, an amorphous semiconductor of a different kind constitutes the heterojunction aperture structure of pn or pin. The optical band gap of the 2nd semi-conductor layer of the aperture ingredient which exists in the incidence side of light It is made larger than the inside 1st semi-conductor layer, and the optical absorption multiplier of the 2nd semi-conductor layer is made small, and light is made not to be absorbed in this 2nd semi-conductor layer by this. Recombination with the electron in a surface layer and an electron hole is reduced, optical absorption loss is mitigated, and the sensibility by the side of short wavelength can be increased, and a wide gap aperture operation can be attained, consequently an energy conversion efficiency can be improved.
[0043] While leading more light energies to the intrinsic-semiconductor layer (i layers) which is especially a photoelectromotive-force generating layer with pin junction structure, the sensibility by the side of short wavelength is increased, and a wide gap aperture operation can be attained. In this invention, energy conversion actuation which was extremely excellent in the way compared with the particle in which the n form Si epidermis section was formed, outside the p form Si ball in the above-mentioned advanced technology will be performed.

[0044] Light is absorbed, an electron and an electron hole pair are made from i layers of an optoelectric transducer which have a pin junction, the duty which generates and conveys a photocurrent is achieved, and p layers and n layers fix Fermi level near a valence band and the conduction band, and achieve the duty which makes the internal field which carries the electron generated in i layers, and an electron hole to two electrodes, and collects optical generation carriers. In this way, improvement in an energy conversion efficiency is achieved.
[0045] Moreover, an optoelectric transducer is characterized by having stack form structure like drawing 17 in this invention including the internal cel 81 which has the 1st semi-conductor layer of the method of the innermost, and the external cel 82 which is formed in a way outside the internal cel, and has the 2nd semi-conductor layer of the outermost direction.
[0046] Moreover, the internal cel 81 is characterized by for this invention having a pn junction layer or a pin junction layer, and the external cel 82 having a pn junction layer or a pin junction layer.
[0047] Moreover, on the other hand, this invention has the 1st semi-conductor layer 84 of an electric conduction format, and amorphous and/or the semi-conductor layer 85 of a microcrystal of an another side electric conduction format in order outside from inside, and, as for the internal cel 81, the external cel 82 is characterized by the thing with a large optical band gap for which it has amorphous or the 2nd semi-conductor layer 87 of a microcrystal outside from inside at order rather than the amorphous pir. junction layer 86 and this pin junction layer.
[0048] This invention like drawing 18 moreover, the internal cel 101 In order, on the other hand, it has the 1st semi-conductor layer 104 of an electric conduction format, and amorphous and/or the semi-conductor layer 105,106 of a microcrystal of an another side electric conduction format outside from inside. The external cel 102 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 107 of an electric conduction format, the amorphous intrinsic-semiconductor layer 108, and the 2nd semi-conductor layer 111 of the microcrystal of an another side electric conduction format outside from inside.
[0049] This invention like drawing 19 moreover, the internal cel 112 In order, from inside, outside The 1st semi-conductor layer 114 with an electric conduction format amorphous on the other hand, It has the amorphous intrinsic-semiconductor layer 115 and the amorphous semiconductor layer 117 of an another side electric conduction format. The external cel 113 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 118 of an electric conduction format, the amorphous intrinsic-semiconductor layer 119, and the 2nd semi-conductor layer 122 of the microcrystal of an another side electric conduction format outside from inside.
[0050] This invention like drawing 20 moreover, the internal cel 124 In order, from inside, outside The 1st semi-conductor layer 126 with an electric conduction format amorphous on the other hand, It has the intrinsic-semiconductor layer 127 of a microcrystal, and the amorphous semiconductor layer 129 with an optical band gap are an another side electric conduction format and larger than the 1st semi-conductor layer. The external cel 125 In order, it is characterized by on the other hand having the microcrystal semi-conductor layer 130 of an electric conduction format, the amorphous intrinsic-semiconductor layer 131, and the 2nd semi-conductor layer 134 of the microcrystal of an another side electric conduction format outside from inside.
[0051] If this invention is followed, a microcrystal (müc) semi-conductor layer can have high conductivity, and can improve photoelectric conversion efficiency by introducing such a microcrystal semi-conductor layer between the 1st semi-conductor layer and a pin junction layer. While the heterojunction of the amorphous pin junction layer and 2nd semi-conductor layer can perform effective collection of an optical generation carrier, loss of recombination of an optical generation carrier is mitigable with an amorphous pin junction layer again.
[0052] By receiving the reflected light by the inner surface of the crevice of a base material, temperature up is carried out to 40-80 degrees C, degradation of the photoelectric transfer characteristic is controlled by this, and the amorphous semiconductor is convenient. Since this optoelectric transducer is formed almost spherically, it will be controlled that the incidence energy of the light per [which receives direct light and the reflected light] unit area becomes large, and degradation of the photoelectric transfer characteristic will be controlled by this.
[0053] Moreover, this invention is characterized by the 1st semi-conductor layer being a direct semiconductor layer.
[0054] Moreover, this invention is characterized by a direct semiconductor layer being one kind chosen from the group who consists of InAs, GaSb, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe.
[0055] If this invention is followed, the direct semiconductor layer which is easy to absorb light can realize the inside 1st semi-conductor layer, sufficient transition probability of an electron and an electron hole can be acquired by this, and photoelectric conversion efficiency can be improved also by this.
[0056] Moreover, two or more base materials adjoin, this invention is arranged, and the periphery of each base material is extended and formed in the method of outside, and it is this periphery and is characterized by the

thing for which the 1st conductor of a base material and the 2nd conductor of the base material of another side are connected electrically repeatedly while adjoining.
[0057] Moreover, said each periphery starts, has a part or a falling part, and starts, and the part or falling part of this invention is characterized by connecting electrically repeatedly.
[0058] If this invention is followed, by the periphery of two or more base materials with which the optoelectric transducer was carried, the 1st conductor of one base material and the 2nd conductor of the base material of another side can be connected in piles, and the high electrical potential difference which carries out the series connection of the photoelectromotive force by the optoelectric transducer for every base material, and wishes for it in this way can be taken out.
[0059] As long as it follows this invention, it falls with the standup part of the periphery of a base material, and a part is connected electrically in piles, or you may make it connect standup parts or falling parts electrically, as shown in below-mentioned drawing 12 and below-mentioned drawing 13 . By this, the crevice of a base material can be approached and as many crevices and optoelectric transducers as possible can be arranged now in a limited area.
[0060]
[Embodiment of the Invention] Drawing 1 is some expanded sectional views of the optical power plant 1 of one gestalt of operation of this invention, drawing 2 is the sectional view showing the configuration of the optical whole power plant 1, and drawing 3 is the decomposition perspective view of the optical power plant 1 shown in drawing 2 . The combination object 4 which consists of two or more optoelectric transducers 2 which have a fundamental almost spherical configuration, and the base material 3 with which that optoelectric transducer 2 is carried is laid underground in the packed bed 5 which consists of a translucency synthetic-resin ingredient, for example, PVB (polyvinyl butyral), EVA (ethylene vinyl acetate), etc., the translucency protection sheets 6, such as a polycarbonate, are arranged and the optical power plant 1 is fixed to this packed bed 5 at a light source side, such as sunlight. The protection sheet 6 of a packed bed 5 and the waterproof rear-face sheet 12 which changes from a synthetic-resin ingredient etc. to the front face of an opposite hand (lower part of drawing 1) are fixed. In this way, the configuration of the optical whole power plant 1 is tabular [flat].
[0061] An optoelectric transducer 2 has the 1st semi-conductor layer 7 and the 2nd semi-conductor layer 8 of the method of outside [it]. Opening 9 is formed in the 2nd semi-conductor layer 8. A part of 1st semi-conductor layer 7 10 is exposed under drawing 1 from opening 9. By irradiating light 11 from the upper part of drawing 1 , photoelectromotive force is outputted from between the 1st and 2nd semi-conductor layer 7 of an optoelectric transducer 2, and 8.
[0062] An electric insulator 15 is sandwiched between the 1st conductor 13 and the 2nd conductor 14, in this way, the 1st and 2nd conductors 13 and 14 are electrically insulated through an electric insulator 15, and a base material 3 is constituted. The 1st and 2nd conductors 13 and 14 may be aluminium foil, and may be other metal sheets. Electric insulators 15 may be synthetic-resin ingredients, such as polyimide, and may consist of other electric insulation ingredients. Two or more crevices 17 of each are formed adjacently, and the inner surface of this crevice 17 is formed with the 1st conductor 13. An optoelectric transducer 2 is arranged at the bottom in each crevice 17, respectively.
[0063] Drawing 4 is some top views of a base material 3. the opening edge 18 of a crevice 17 -- a polygon -- it is -- for example, -- the gestalt of this operation -- a swage block -- it may be forward six square shapes of a **, and you may be other polygons of three or more square shapes with other gestalten of operation of this invention, for example. In drawing 4 , the die length W1 of the opening edge 18 may be 2mm. Each opening edge 18 which adjoins mutually stands in a row in succession by the inverted-L-shaped flection [in / in a crevice 17 / drawing 1] 19. As many crevices 17 as possible can be formed in the area which attends light 11 by this, therefore the reflected light by the 1st conductor 13 of the inner surface of a crevice 17 can be reflected and led to an optoelectric transducer 2, and a condensing ratio can be enlarged.
[0064] A crevice 17 is formed in parabolic in the shape of a taper, for example as it becomes a bottom. The 1st semi-conductor layer 7 of an optoelectric transducer 2 is electrically connected [at the bottom of a crevice 17] to the 2nd conductor 14 of a base material 3 in a connection 21. The 2nd semi-conductor layer 8 of an optoelectric transducer 2 is the bottom of a crevice, or its circumference, and is electrically connected to the 1st conductor 13 of a base material 3.
[0065] Drawing 5 is the sectional view showing the optoelectric transducer 31 in the condition before being carried in the base material 3 of an optoelectric transducer 2. The optoelectric transducer 31 of drawing 5 has cross-section structure similar to above-mentioned drawing 1 . The 1st semi-conductor layer 7 is spherical, and consists of the n form Si. The 1st semi-conductor layer 7 may be amorphous one, a single crystal, or polycrystal. The 2nd semi-conductor layer 8 formed in a way outside this 1st semi-conductor layer 7 is the p form Si. This 2nd

semi-conductor layer 8 may be amorphous one, a single crystal, or polycrystal. If this 2nd semi-conductor layer 8 takes a large optical band gap rather than the 1st semi-conductor layer 7, p form a-SiC, then a wide gap aperture operation will be attained, for example.
[0066] With other gestalten of operation of this invention, the 1st semi-conductor layer 7 shown in drawing 5 may be one kind chosen from the group who consists of InAs which is realized by the direct semiconductor layer, for example, has n form electric conduction format, CuInSe2, Cu(InGa) Se2, CuInS, GaAs, InGaP, and CdTe. The 2nd semi-conductor layer 8 is formed on the 1st semi-conductor layer 7 formed of this direct semiconductor layer, and this 2nd semi-conductor layer 8 is one kind chosen from the group of a compound semiconductor similar to Semi-conductor AlGaAs and CuInSe2 which have p form electric conduction format, Cu(InGa) Se2, GaAs, AlGaP, CdTe, or it. In this way, pn junction structure is formed.
[0067] Like below-mentioned drawing 6 , between the 1st semi-conductor layer 68 and the 2nd semi-conductor layer 70, i semi-conductor layer 69 is formed and pin junction structure may be formed of this at the process which uses an amorphous semiconductor for the 1st and 2nd semi-conductor layers 7 and 8.
[0068] How to manufacture the combination object 4 with the base material 3 shown in drawing 1 is explained below using the optoelectric transducer 31 shown in drawing 5 .
[0069] Drawing 6 is a sectional view for explaining how to manufacture the combination object 4 which has an optoelectric transducer 2 and a base material 3. After the spherical optoelectric transducer 2 shown in above-mentioned drawing 5 is manufactured, as shown in drawing 6 , cutting of the optoelectric transducer 2 is carried out. In the optoelectric transducer 2 shown in drawing 6 , a part of 1st semi-conductor layer 7 10 is exposed from the opening 9 of the 2nd semi-conductor layer 8. As for this opening 9, the central angle theta 1 is formed in a plane in less than 180 degrees. The central angle theta 1 may be 45-90 degrees, and may be 60-90 degrees preferably. The outer diameter D1 of an optoelectric transducer 31 may be for example, under 0.5-2mmphi, and is 0.8-1.2mmphi still more preferably. The bore of opening 9 is shown by the reference mark D2. Condensing ratio x=S1/S2 is two to 8 times, and is four to 6 times preferably.
[0070] Drawing 7 is a sectional view for explaining the process which carries out cutting of the spherical optoelectric transducer 31, and forms opening 9. Vacuum attraction of the upper part is carried out with the attraction pad 34, respectively, and two or more spherical optoelectric transducers 31 are ground with the endless belt-like abrasives 35. Revolution actuation of the abrasives 35 is wrapped and carried out over rollers 36 and 37.
[0071] Again, with reference to drawing 6 , in manufacture of a base material 3, the 1st conductor 13 of aluminium foil is prepared and the connection hole 39 is formed in this 1st conductor 13. The bore D3 of the connection hole 39 is less than one outer diameter D of an optoelectric transducer 2, and is chosen as the value exceeding the bore D2 of the opening 9 of the 2nd semi-conductor layer 8 (D1>D3> D2). The sheet metal-like electric insulator 15 is prepared and the connection hole 40 is formed in this electric insulator 15. The bore D4 of the connection hole 40 is less than two bore D of the opening 9 of an optoelectric transducer 2 (D2> D4). In this way, the 1st conductor 13 which has the connection hole 39, and the electric insulator 15 which has the connection hole 40 pile up and paste up, and is unified, and each axis of these connection holes 39 and 40 exists on a straight line. Furthermore, the 2nd conductor 14 piles up and pastes up, and is unified, and flat base material 3a is formed. With other gestalten of operation of this invention, the 1st conductor 13 which has the connection hole 39, the electric insulator 15 which has the connection hole 40, and the 2nd conductor 14 pile up simultaneously, paste up, and may be unified. The thickness of the 1st and 2nd conductors 13 and 14 and an electric insulator 15 may be 60 micrometers. Near [opening 9] an optoelectric transducer 2 fits into the connection hole 39, and the connection hole 40 of an electric insulator 15 is faced it. The connection hole 39 is faced said opening 9 neighborhood, and it may be placed on the 1st conductor 13.
[0072] Drawing 1 is also referred to collectively and the part which surrounds the 1st connection hole 39 the peripheral face which surrounds the opening 9 of the 2nd semi-conductor layer 8 rather than the opening 9 of an optoelectric transducer 2 in the upper part of drawing 1 , the inner skin of the part 39 of 1st connection hole 39 near [the 1st conductor 13 of base materials 3a or 3], i.e., the 1st connection hole, or near [1st connection hole 39] the is connected electrically. The amount of [of the peripheral face of the 2nd semi-conductor layer 8 and the 1st conductor 13 / 44 (refer to drawing 1)] connection It is located in an opposite hand (upper part of drawing 1) in the 1st conductor 13 rather than the periphery section 45 of the virtual flat surface containing opening 9. It prevents certainly the 1st conductor 13 flowing electrically with the 1st conductor 7 by this, and exists in an opening 9 side (lower part of drawing 1) rather than the virtual flat surface 47 which is parallel to the virtual flat surface containing opening 9 as for a part for this connection 44, and passes along the core 46 of an optoelectric transducer 2.
[0073] Then, plastic deformation processing of the flat base material 3a is carried out with a press, and two or

more crevices 17 adjoin and are formed. The 2nd conductor 14 deforms so that a projection 40, i.e., a connection hole, may be inserted in above drawing 6 and it may upheave from the connection hole 40 of an electric insulator 15, and a connection 21 is formed. In this way, the height H1 of the formed base material 3 may be about 1mm.

[0074] Any may be first performed on a target one by one, or the electrical installation process of the 1st semi-conductor layer 7 and the 2nd conductor 14 and both the processes with the electrical installation process of the 2nd semi-conductor layer 8 and the 1st conductor 13 may be performed simultaneously again.

[0075] In this way, the optoelectric transducer 2 which has opening 9 in the formed crevice 17 is arranged.

[0076] With other gestalten of operation of this invention, after carrying out plastic deformation processing of the three-tiered structure of the 13/insulator 15 of conductors/a conductor 14 so that a crevice 17 may be formed, each above-mentioned openings 39 and 40 may be formed in a conductor 13 and an insulator 15 using two kinds of each laser beam, respectively, and a base material 3 may be manufactured.

[0077] Drawing 8 is the simplified perspective view showing the process which arranges an optoelectric transducer 2 in the crevice 17 of a base material 3. The optoelectric transducer 2 by which cutting was carried out where vacuum attraction is carried out with the attraction pad 34 in above-mentioned drawing 7 is conveyed and arranged in the crevice 17 of a base material 3 with the position which the opening 9 faced caudad. Two or more, 100 pieces and a train are accomplished and the attraction pad 34 is formed. After the optoelectric transducer 2 has been arranged in a crevice 17 with the attraction pad 34, only one pitch of a crevice 17 is moved to a travelling direction 42, and a base material 3 arranges an optoelectric transducer 2 to the new crevice 17 using the attraction pad 34 like the above-mentioned. Such actuation is repeated and an optoelectric transducer 2 is arranged in all the crevices 17. Then, an optoelectric transducer 2 is electrically connected to a base material 3 at the bottom of a crevice 17.

[0078] It exposes by opening 32 and the 1st semi-conductor layer 7 of an optoelectric transducer 2 is electrically connected to a connection 21 with the connection hole 40 of the 2nd conductor 14. Moreover, as for the 2nd semi-conductor layer 8 of an optoelectric transducer 2, the periphery section of the upper part of opening 9 is connected to the part and the electric target of the connection hole 39 neighborhood of the 1st conductor 13. Each electric connection with these 1st and 2nd conductors 13 and 14 and 2nd and 1st semi-conductor layers 8 and 7 of an optoelectric transducer 2 may be electrically connected using a metal bump using a laser beam, using an eutectic or a conductive paste. In this way, without using the solder containing lead, electrical installation can be performed and it is desirable from a viewpoint of environmental protection.

[0079] Drawing 9 is the perspective view showing the condition that the combination objects 4 and 4b which have an optoelectric transducer 2 and a base material 3 were connected. Electric connection is made by the plane peripheries 61 and 61b prolonged in a way outside the combination objects 4 and 4b.

[0080] Drawing 10 is the periphery 61 of the combination objects 4 and 4b shown in drawing 9 , and a decomposition sectional view near 61b. On the 1st conductor 13 of the base material 3 of one combination object 4, it connects electrically repeatedly and the 2nd conductor 14 of base material 3b of another side is fixed. In this way, the high electrical potential difference which carries out the series connection of the photoelectromotive force by two or more base materials 3 and the optoelectric transducer 2 of every 3b, therefore he wishes can be taken out.

[0081] Drawing 11 is the simplified side elevation showing the condition of having connected electrically the combination objects 4, 4b, and 4c. While adjoins and periphery 61of combination object 4b of another side b is electrically connected on the periphery 61 of the combination object 4, or to the bottom as mentioned above in piles. Furthermore, the above-mentioned periphery 61b of combination object 4b and the periphery 61b1 of an opposite hand are put on periphery 61of adjoining combination object 4c c up and down, and are electrically connected to it. With the configuration arranged as one periphery 61b of combination object 4b is shown in drawing 11 under the periphery 61b of the combination object 4, the periphery 61b1 of another side is arranged in the upper part of periphery 61c of combination object 4c, so to speak, is together put up and down by turns in the shape of two step in this way, and is connected. The die length L61 with which the longitudinal direction in a periphery 61, 61b;61b1, and drawing 11 of 61c lapped may be 1mm.

[0082] Drawing 12 is the sectional view showing the electric connection structure of the adjoining combination objects 4 and 4b. The periphery 61 of one combination object 4 has started, and periphery 61of combination object 4b of another side b falls, and is formed. The conductor 14 in a periphery 61 and the conductor 13 of periphery 61b are connected electrically.

[0083] Drawing 13 is the sectional view showing the electrical installation condition of the combination objects 4 and 4b in other gestalten of operation of this invention. Although the gestalt of this operation is similar to the gestalt of operation of drawing 12 , with the gestalt of this operation, the conductor 13 of a periphery 61 with which the combination object 4 started is especially connected to the conductor 14 of periphery 61b with which

combination object 4b fell electrically. According to such drawing 12 and the connection structure of drawing 13 , the crevice of base materials 3 and 3b can be approached, and as many crevices and optoelectric transducers as possible can be arranged now in a limited area.
[0084] Drawing 14 is some sectional views of the optoelectric transducer 2 of other gestalten of operation of this invention. each semi-conductor layer is shown by the flat configuration developed to the hoop direction at drawing 14 and below-mentioned drawing 15 - drawing 20 -- also although kicked, actually, a laminating is carried out to the shape of radii one by one toward the upper part at a target from the lower part from the method of the inside of radial to the method of outside, i.e., each drawing, and it has the spherical surface and is formed.
[0085] In drawing 14 , it has the configuration which has the n form microcrystal (muc) Si layer 63 and the double heterojunction layer of the n form polycrystal (poly) Si layer 64/p form a-SiC layer 65/p form microcrystal SiC layer 66 on a target one by one toward the method of outside from the method of the inside of radial of an optoelectric transducer. The configuration of the optoelectric transducer which has such pn junction is shown in a table 1.
[0086]
[A table 1]

図	参照符	層
14	66	p μc−SiC
	65	p a−SiC
	64	n poly Si
	63	n μc−Si
15	70	p a−SiC
	69	i a−SiC
	68	n μc−Si
16	77	p μc−SiC
	76	p a−SiC
	75	i a−SiC
	74	i a−Si
	73	n μc Si

[0087] Drawing 15 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. Each semi-conductor layers 68, 69, and 70 have the configuration of the above-mentioned table 1. With other gestalten of operation of this invention, Si of the single crystal of n form or polycrystal may be used as a semi-conductor layer 68 in the optoelectric transducer 2 of drawing 15 .
[0088] Drawing 16 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. The concrete configuration of each semi-conductor layer is as being shown in the above-mentioned table 1. With other gestalten of operation of this invention, the semi-conductor layers 73 and 74 in this drawing 16 may be n form crystals Si. Moreover, the semi-conductor layer 74 may be i form microcrystal Si.
[0089] Drawing 17 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. The optoelectric transducer 2 of drawing 17 - drawing 20 has the stack structure of 2 junction. With other gestalten of operation of this invention, the optoelectric transducer 2 which has the stack structure of 3 or

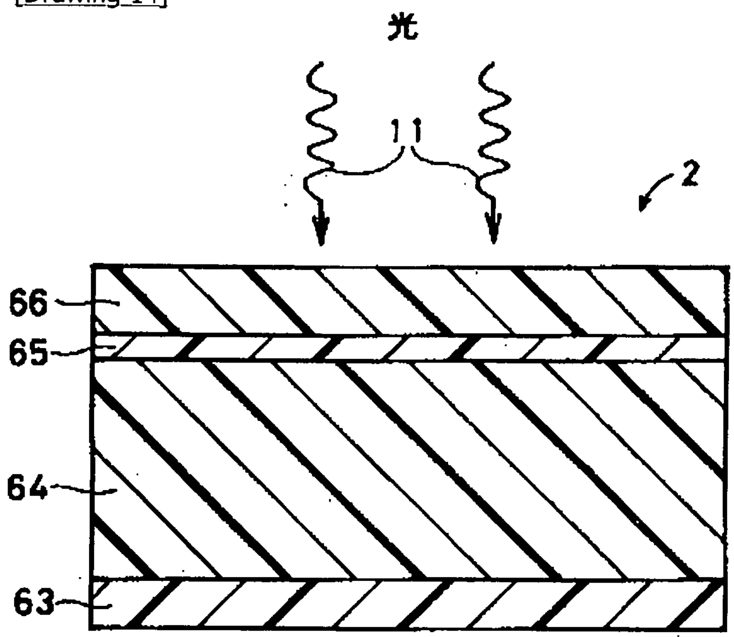
more ****s may be used. The concrete configuration of each optoelectric transducer 2 of drawing 17 - drawing 20 is as being shown in a table 2.
[0090]
[A table 2]

図		参照符	層
17	外部セル 82	87	a－SiC
		86	a－Si pin
	内部セル 81	85	p a－Si
		84	n poly－Si
18	外部セル 102	111	p μc－SiC
		110	p a－SiC
		109	i a－SiC
		108	i a－Si
		107	n μc－Si
	内部セル 101	106	p μc－SiC
		105	p a－SiC
		104	n poly－Si
		103	n μc－SiC
19	外部セル 113	122	p μc－SiC
		121	p a－SiC
		120	i a－SiC
		119	i a－Si
		118	n μc－Si
	内部セル 112	117	p a－SiC
		116	i a－SiC
		115	i a－Si
		114	n a－SiC
20	外部セル 125	134	p μc－SiC
		133	p a－SiC
		132	i a－SiC
		131	i a－Si
		130	n μc－Si
	内部セル 124	129	p a－SiC
		128	i a－Si
		127	i μc－Si
		126	n a－Si

[0091] In drawing 17 , the external cel 82 is formed in a way outside the internal cel 81. The semi-conductor layer 84 may be n form amorphous silicon, the semi-conductor layer 85 may be p form microcrystal Si, and the semi-conductor layer 87 may be Microcrystal SiC further. At a target the pin junction layer of the semi-conductor

layer 86 from the method of the inside of radial of an optoelectric transducer 2 one by one to the method of outside p form, Although the laminating of each semi-conductor layer of i form and n form may be carried out and it may be constituted, with other gestalten of operation of this invention The electric conduction format of the semi-conductor layers 84 and 85 of the internal cel 81 is made into reverse with drawing 17 , and the electric conduction format of the semi-conductor layers 86 and 87 of the external cel 82 is made into reverse with drawing 17 . In this semi-conductor layer 86 The semi-conductor layer of n form, i form, and p form may be formed in a target one by one, it is as above-mentioned and this has it about the optoelectric transducer 2 equipped with the pin junction layer which has other configurations. [same]
[0092] Drawing 18 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. To the internal cel 101 and the external cel 102, the laminating of semi-conductor layer 103-106;107-111 is carried out, and they are constituted.
[0093] Drawing 19 is the sectional view of the optoelectric transducer 2 of other gestalten of operation of this invention. To the internal cel 112 and the external cel 113, the laminating of semi-conductor layer 114-117;118-122 is carried out, and they are constituted. It may replace with the semi-conductor layer 117, and you may be p form amorphous silicon O. The semi-conductor layer 121 may be p form amorphous silicon O similarly.
[0094] Drawing 20 is the sectional view of the optoelectric transducer 2 of the gestalt of the operation of further others of this invention. As for the internal cel 124 and the external cel 125, semi-conductor layer 126-129;130-134 are formed. It replaces with the semi-conductor layer 129, and p form amorphous silicon O may be used.
[0095] The optoelectric transducer 2 of this invention may have configurations other than the above-mentioned configuration. With other gestalten of operation of this invention, it replaces with a base material 3, for example, conductive ingredients, such as nickel, may be plated on the front face, the 1st and 2nd conductors may be formed [a crevice may be formed with shaping of injection molding, such as electric insulation synthetic-resin ingredients, such as a polycarbonate, etc.,] in it, and a base material may be manufactured. Although the 1st and 2nd conductors may be aluminium foil, they may be formed of Cr plating or Ag plating, and may form these metals nickel, Cr, aluminum, and Ag etc. by vacuum evaporationo or the spatter further. An enveloping layer may be formed on the 1st conductor, and this enveloping layer may be metal formed of plating etc., or may be a product made of synthetic resin.
[0096]
[Effect of the Invention] According to this invention, the amount of the ingredient of an optoelectric transducer and especially expensive Si used is reduced substantially, the number of optoelectric transducers is decreased further, the connection routing of an optoelectric transducer and a base material is simplified, it does in this way, productivity improves, and the cost price is reduced. By using especially the optoelectric transducer of this invention, it is realizable by the manufacture approach of saving resources and an energy-saving form. The reflected lights, such as sunlight by the 1st conductor which forms the inner surface of the crevice of a base material, or its enveloping layer, are irradiated at an optoelectric transducer, and light can be used effectively. It connects with the 2nd semi-conductor layer of an optoelectric transducer, and the 1st conductor or its enveloping layer achieves the work which draws a current while achieving the work which reflects light. The configuration of such a base material is simple and productivity is excellent.
[0097] according to especially this invention -- the outer diameter of an optoelectric transducer -- 0.5-2mmphi, while choosing it as 0.8-1.2mmphi preferably The effectiveness which stood high that the amount of Si used of per generating power 1W and the number which needs an optoelectric transducer can be sharply decreased to 1 / 5 - 1/10 compared with the 3rd above-mentioned advanced technology 2-8, and by choosing it as 4-6 preferably in the condensing ratio x can be attained now. While an optical power plant is cheaply realizable by reducing the amount of Si used, the number of optoelectric transducers will be decreased, the electric connection routing of an optoelectric transducer and a base material will be simplified, productivity will improve in this way, and a cheap optical power plant will be realized by this. Therefore, high-reliability and an efficient optical power plant can be offered now.
[0098] According to this invention, the optical band gap of the outside amorphous 2nd semi-conductor layer is made larger than the 1st semi-conductor layer by the side of a core, pn junction or a pin junction is constituted, by this, it prevents from absorbing light in the 2nd semi-conductor layer of the aperture ingredient by the side of the incidence of light, recombination by the surface layer can be reduced, a wide gap aperture operation can be attained, and improvement in photoelectric conversion efficiency can be aimed at.
[0099] Moreover, according to this invention, improvement in an energy conversion efficiency can be aimed at by intervening the high microcrystal (muc) semi-conductor layer of conductivity between the 1st semi-conductor layer by the side of a core, and the pin junction layer of the method of outside [it].
[0100] Moreover, according to this invention, it is also possible to improve an energy conversion efficiency using

the transited [directly] type 1st semi-conductor layer.
[0101] Moreover, according to this invention, manufacture of an optoelectric transducer is easy.
[Procedure amendment 2]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 14
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 14]



[Translation done.]